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ON THE PREPARATION

OF

PRINTING INK.

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ON THE PREPARATION

OF

PRINTING INK.

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ON

THE PREPARATION

OF

PRINTING INK;

BOTH

BLACK AND COLOURED.

BY WILLIAM SAVAGE,

AUTHOR OF "PRACTICAL HINTS ON DECORATIVE PRINTING."

LONDON:

PRINTED FOR THE AUTHOR, AND SOLD BY

LONGMAN, REES, ORME, BROWN, GREEN, AND LONGMAN.

1832.

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PREFACE.

THE process of making Printing Ink has never yet been treated of fully by any practical man, either printer or manufacturer, so that this work will come before the Public on a subject as new as it is important.

This assertion may perhaps appear to require some modification, as the following pages will present to the Reader many receipts for making Printing Ink by preceding authors: but when it is known that this subject is only treated of incidentally by some, and that others of them were not professionally printers, and therefore could scarcely be expected to know what was the desideratum, much less to attain it, we shall have little cause to wonder that all have failed. That they have failed, admits of no question: a long experience in the art of printing in all its branches enables and obliges me to say, that

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Ink made from any one of these receipts could not be used in any printing office in the Metropolis.

Moxon, who wrote the first practical work on printing, gives a detailed method of preparing Printing Ink after the Dutch manner, which he highly praises; yet this Ink would be deemed worthless at present, and although as good as the succeeding ones, he is never quoted on this subject, yet, when types are treated of, his name appears in every subsequent work on Printing. I believe few printers know his book, the title of which is, "Mechanick Exercises: or, the Doctrine of Handy-works. Applied to the Art of Printing. By Joseph Moxon, Member of the Royal Society, and Hydrographer to the King's Most Excellent Majesty." 2 vols. 4to. 1677, and which has served as the foundation of subsequent works on Printing.

M. le Breton, Printer to the King of France, is the next author on this subject. He wrote the article on Printing in the French Encyclopédie, of which the method of making Printing Ink forms a part. He is continually quoted by succeeding writers, yet his Ink would not rank higher than Moxon's in a printing office.

J. B. Papillon, a celebrated French engraver on wood, published a Treatise on that subject, in

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which he gave a detailed account of the process of making Printing Ink, which would not be in greater estimation than Moxon's and Breton's.

Lewis, in his Philosophical Commerce, of Arts, relates the results of many experiments on boiling oil, which are of little practical use, and gives the process of making Ink from Breton.

Nicholson, in his Dictionary of Chemistry, gives some passages which purport nothing, and then proceeds to a loose description of the process from Lewis.

The Messrs. Aikin, in their Dictionary of Chemistry, give a short vague article on the subject, quoting Lewis as their authority.

Rees's Cyclopædia contains an article on the subject, also from Lewis.

The Printer's Manual, a French work, published in 1817, gives an account of the process, founded on Breton's formula.

The Encyclopædia Britannica is the only work to my knowledge which has broken through the trammels of obsolete authorities, and given a receipt by which a Printing Ink might be made that could be used; but the editor candidly acknowledges that the article produced would be of an inferior quality.—It is, however, the only

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real approximation to the knowledge of making an Ink that could be worked with; and yet it is deficient in specifying the qualities of the different materials, and also of their due proportions, so that it would not produce a clean working Ink, nor an Ink of a good colour.

The information given in the following pages is not theoretical, but deduced from my own practice; and there is not an article mentioned in the whole Treatise but what I have repeatedly employed, nor a receipt given but what has undergone the strictest ordeal — that of being used in the regular way of business. The fine black Ink has been pronounced by some of our first printers unrivalled; and the Ink for general purposes has been allowed by the most competent judges to be fully equal to the high priced Inks of the principal manufacturers.

I have used them myself, and also superintended their use by others to the extent of thousands of impressions printed consecutively, without having found occasion to wash or clean the form or engraving, and this in producing fine work. I am, through this experience, enabled to assert, that I do not think it possible that Inks could be produced that would work cleaner or more freely, produce finer impressions, and retain their freshness of colour

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without imparting stain to the paper, than the Inks, both black and coloured, the receipts of which I have published in this work.

The Society for the Encouragement of Arts showed their sense of my success in this pursuit by awarding to me their large medal, and a sum of money, for my imitation of drawings printed from engravings on wood with Inks of my own preparing; and by an invitation to furnish them with a Paper on the Preparation of Printing Ink.

Knowledge of such a subject as this on which I am treating, must, to possess any value, be practical, not theoretical: without being so, there would not exist a possibility of accurately knowing the imperfections existing in the Inks, of estimating the errors and deficiencies, and, least of all, of providing a remedy. Thirty-six years practice in the metropolis, with some previous ones in the country, spent in executing the most common as well as the most splendid works, may perhaps entitle me to feel competency to my undertaking, and encourage the belief of it in others.

To printers generally I feel that this work will be of great service, judging from the absolute want of information on the subject, a want that I have experienced in a very high degree during my practice. It will enable every printer to pre-

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pare a good Ink himself, and to have it always of an uniform quality; — it will enable him to prepare the finest Ink without any risk or danger; — it will enable him to prepare coloured Ink of any hue at half an hour's notice, that will work as clean as black Ink, when any fancy work is required; — it will enable him to print bankers cheques, &c. with a changeable Ink, to prevent fraudulent alterations: — it is in fact opening a door to the extension of the powers of the printing press which has hitherto been closed and sealed.

The price charged for this small volume might be thought high, if its value were to be estimated by its size; but when it is considered that in it is condensed the information which it has cost me years of application and much money to acquire, that I have made hundreds of experiments, the result of which I am now laying before the Public, I consider that I propose to myself a low remuneration. I have known twenty guineas given for one of those receipts that I have in this work proved to be worthless: and when the late Earl Stanhope was prosecuting his plans for improving other departments of the art, he gave one hundred pounds for another receipt. These considerations satisfy me, and I feel assured will satisfy

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the purchaser, that my desire has been rather to benefit him than to enrich myself.

I have confined myself to a statement of facts, which I have endeavoured to express in a clear and explicit manner, so that there should be no ambiguity in the meaning; and in a practical book I feel that this is preferable to long declamatory reasoning, which in general is unsatisfactory, and answers no purpose but that of unnecessarily swelling out the size of the book.

After having extended and shown the powers of the printing press as applied to the imitation of drawings, so as to deceive some of the best judges, both amateurs, artists, and printers, in my Work on "Decorative Printing;"—having now laid before the Public the whole that has been published on the Preparation of Printing Ink, with the result of my own experiments for many years in an unreserved manner;—it is my intention, if the Almighty should be pleased to prolong my life and health, to complete a general practical work on Printing, as carried on in the principal Offices in London at the present time, which I have had many years in hand, to be comprised in one volume octavo: this work will not be a compilation from old authors, whose descriptions are now become obsolete, but will be original, derived from my

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own long practice in the art in all its branches, and assisted by some of the best Printers in the Metropolis, and will include a great mass of information, that will be found of material service to the Apprentice, the Compositor, the Reader, the Pressman, the Warehouseman, the Overseer, the Master Printer, the Bookseller, and the Gentleman who may be connected with literary pursuits. When I have completed this Work I feel that I may stop on this subject, as I shall then have laid before the Public more genuine information on the practical part of Printing than any preceding writer.

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ON THE PREPARATION

OF

PRINTING INK.

CHAPTER I.

INTRODUCTORY OBSERVATIONS ON PRINTING INK.

PRINTING INK of a rich and durable tone, and of a superior quality, is so essential to the appearance of an elegant book, that it is impossible for any Printer to produce a splendid work, even with all the skill and improved knowledge of the present times, except he be provided with such an article.

The want of this superior article has been severely felt by numerous Printers who aspired to rank with the few who had obtained pre-eminence in this art; but they invariably failed in their endeavours, although in their profession possessed of skill, the best materials, and an anxious desire to rival the beautiful productions

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which issued from the presses of Bensley and of Bulmer, of Davison, Whittingham, &c.

The real grievance was, that there was not any good Printing Ink to be purchased; and after procuring the best that could be obtained, and bestowing the utmost care and skill upon their work, and making it look of a very superior character when first printed, they had the mortification to find, after a few months had elapsed, that the Ink turned brown, the edges of the letters and the back of the page were stained yellow, owing to the oil in the Ink having separated from the colouring matter, and that it thus disfigured the paper, and destroyed the beauty of their work and of the book; while the productions of those few who had raised themselves to eminence in the art remained unchanged, preserving all their pristine beauty.

The principal cause of this eminence was the superior quality of the Ink they used, which they prepared themselves, and kept the method of so doing a profound secret, which they guarded with the utmost care and strictness, and thus preserved the monopoly of fine printing in their own hands.

At the time that I am speaking of, the production of Macklin's Bible, Bowyer's History of England, and Boydell's Shakspeare — which were exertions to rival and excel the famed

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typographical works of Bodoni at Parma, and Didot at Paris—so greatly surpassed any thing that had previously proceeded from the English press, as to have induced a great spirit of emulation to improve printing generally in England, which then consisted of two kinds only —the commonest and the finest that could be produced. Other causes also combined to strengthen this spirit; namely, the increased diffusion of knowledge by the institution of Sunday Schools, and the introduction of Bell's and of Lancaster's systems of education, which increased the number of readers, increased the demand for books, increased the number of printers to meet that demand, and consequently increased that emulation to enable them to enter into competition with those who had obtained a great name in the art. Another cause also operated to produce an improvement in printing—the Act of the thirty-ninth of George the Third, Chapter seventy-nine, for the Suppression of Seditious Societies, obliged every printer to affix his name and address to what he printed; thus those who exerted themselves to produce neat work came conspicuously before the public, while it stimulated the slovenly and careless to exert themselves in order to preserve their business, and equal their active competitors.

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But, as I have previously observed, the want of good Printing Ink was a serious drawback on these exertions towards a general improvement of the art of printing; for although the few Ink makers by profession endeavoured to improve the article, yet either from a want of knowledge of the qualities that were required, or of the properties of the ingredients or the process of compounding them, or of all these qualifications together, it is an undoubted fact that their improvements did not equal nor even keep pace with the skill of the printer in his manipulations. I have been continually for many years in the habit of looking at printing at the press side, which has appeared of a superior quality; but when I have examined the same sheets after a lapse of one or two years, the beauty of the printing had disappeared; the Ink had acquired a brown colour, and the paper, to the size of the printed page, by reason of the oil being imperfectly prepared, was stained of a dirty yellowish brown colour, and thus all the skill, expence, and care, bestowed on the workmanship were rendered of no avail.

Yet it would be unfair to the manufacturers of Printing Ink to assert that no improvement in the article has taken place; for as their number increased, it caused competition and excited a spirit of emulation among them, that has cer-

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tainly been the means of improving the Ink of commerce; but still, as I have just observed, it has not kept pace with the general improvement in the art of printing.

Even the limited knowledge that is possessed by the very few manufacturers of this article of the properties required in its composition, is carefully guarded as a profound secret; so that the printer who may be desirous of having Ink of a very superior quality is not able to form it de novo, for want of information on the subject, but is obliged to take the Ink of commerce as a foundation to work upon, and improve that which he thus tacitly acknowledges is of an inferior quality, and to attempt to change that which is bad inherently to excellence:—the thing is impracticable.

It is my intention, in the following pages, to endeavour to supply this desideratum in the art of printing, for, except in my work on Decorative Printing, there are no directions published by which Ink can be made which the workmen of the present day could use, on account of the despatch that is required. The Ink made by any of these directions would invariably clog up the type in a few impressions, and the form would have to be brushed over with lie repeatedly, and washed and dried,

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to the great delay of business and loss to the workmen, independently of the very inferior article that would be produced in the quality of the printing, and with machines it would be impossible to use it: the receipt which I published was for a very superior and expensive Ink, that would not be suitable for the general run of business.

I shall insert all the receipts that have been published in respectable works, and which have been repeatedly quoted and praised, with some observations on each of them, to show in what they fail;—this I am induced to do that the reader may have before him all that has been written on the subject by men of abilities,—and then add the result of my own labours, which is derived from long-continued numerous experiments and practical experience.

Nicholson, a man of science, and of great research in the processes of arts and manufactures, in his "Dictionary of Chemistry," when treating on this subject says, "the particulars of the process by which Ink of the best quality is made are kept secret by the few manufacturers of this article. It is probable, that the demand is not sufficient to afford inducements for men of research to make many experiments on this subject, and it is not unlikely that

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much may depend on minute circumstances in the management."

To me it appears that all the directions which have been published had one origin, and that they have been given with some slight variations uninterruptedly from the latter part of the seventeenth century; for the first that I can trace were given by Moxon, in his "Mechanick Exercises," in 1677, as the method practised by the Dutch in making Ink, which he praises highly as being much superior to the English method; but whoever looks at the productions of the press at that period, when the art was at its lowest state, and compares them with those of the present day, will immediately perceive that the ink then used would not answer now, even for its appearance, without taking into consideration the foulness of its working.

From the superior description of Works entrusted to me to print, I was obliged, in order to equal the productions of our best printers, to turn my attention seriously to this subject in the year 1808; and I then found, from repeated disappointments, that it required a printer, who knew from practical experience what properties were required in Ink, to make a real improvement on the article of commerce;

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and when I was engaged on my work on Decorative Printing, I was still further obliged to pursue my object by dint of experiments in coloured Inks, for there existed no precedents to guide me; and I feel a high gratification in perceiving the great improvement that has taken place in ornamental printing since the publication of that book.

The information which I am now throwing open to the Public is the result of twenty-three years of application devoted to this peculiar subject. I have pursued my object with ardour, because I saw in it capabilities which I believed I saw alone. Wonderful and extensive as is the power of the printing press in diffusing knowledge over the globe, I saw and felt that it had yet a capability untried and unacknowledged of producing works that might deservedly raise its claims to rank among the Fine Arts. I have had the satisfaction of realizing my expectations: I have shown in my work on Decorative Printing how successfully drawings may be imitated by means of the common printing press, to the surprise of all who could estimate the difficulties attendant on such an undertaking, towards which no precedent information existed, and wherein every advance was made by dint of experiment.

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CHAPTER II.

ON THE PREPARATION OF PRINTING INK BY DIFFERENT AUTHORS ALREADY PUBLISHED, WITH OBSERVATIONS ON THE PROPERTIES OF EACH.

In most of the works that have been published on printing, in Encyclopædias, and in other works connected with science, there have been given receipts for making Printing Ink, which have been extolled as being valuable, and as giving information to the printer that would be highly serviceable.

It is evident to me, that these recommendations would mislead every one who placed confidence in them and trusted to the directions given, and also cause disappointment, as a Printing Ink made from any one of those receipts could not be used in the general way of business at the present day; that in the

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Encyclopædia Britannica, perhaps, might be excepted, but it would only do for the commonest work; being inferior in quality, and the proportions of the ingredients incorrect, it would work foul; it is however the only one that has been published to my knowledge from which an Ink might be made that could be used.

As these receipts are scattered in books, some of which are scarce and others expensive, they are of consequence not of easy or of general reference; I have therefore collected them, and given them in this Treatise in the authors' own words, that the reader may have before him the whole that has been published in respectable works on this subject. Those of Fertel, of M. Breton, Printer to the King of France, of Papillon, and the one in the Printer's Manuel, a French work, I have had translated, as they have not previously been published in English.

Any observations that I may think it necessary to make — on the materials specified in these receipts — on the method of making the varnish — and on the preparation of the Ink, with its probable qualities — I shall annex to each receipt.

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The Dutch Method of making Printing Ink, as given by MOXON *in his Mechanick Exercises. Edit.* 1683.

"¶ 23. *Of* Inck.

"The providing of good *Inck*, or rather good *Varnish* for *Inck*, is none of the least incumbent cares upon our *Master-Printer*, though Custom has almost made it so here in *England;* for the process of making *Inck* being as well laborious to the Body, as noysom and ungrateful to the Sence, and by several odd accidents dangerous of Firing the Place it is made in, Our *English Master Printers* do generally discharge themselves of that trouble; and instead of having good *Inck*, content themselves that they pay an *Inck-maker* for good *Inck*, which may yet be better or worse according to the Conscience of the *Inck-maker*.

"That our Neighbours the *Hollanders* who exhibit Patterns of good *Printing* to all the World, are careful and industrious in all the circumstances of good *Printing*, is very notorious to all Book-men; yet should they content themselves with such *Inck* as we do, their Work would appear notwithstanding the other circumstances they observe, far less graceful than it does, as well as ours would appear more beautiful if we used such *Inck* as they do: for there is many Reasons, considering how the *Inck* is made with us and with them, why their *Inck* must needs be better than ours. As

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First, They make theirs all of good old *Linseed-Oyl* alone, and perhaps a little *Rosin* in it sometimes, when as our *Inck-makers* to save charges mingle many times *Trane-Oyl* among theirs, and a great deal of *Rosin;* which *Trane-Oyl* by its grossness, Furs and Choaks up a *Form*, and by its fatness hinders the *Inck* from drying; so that when the Work comes to the *Binders*, it *Sets off;* and besides is dull, smeary and unpleasant to the Eye. And the *Rosin* if too great a quantity be put in, and the *Form* be not very *Lean Beaten*, makes the *Inck* turn yellow: And the same does New *Linseed-Oyl.*

" *Secondly*, They seldom *Boyl* or *Burn* it to that consistence the *Hollanders* do, because they not only save labour and Fewel, but have a greater weight of *Inck* out of the same quantity of *Oyl* when less *Burnt* away than when more burnt away; which want of Burning makes the *Inck* also, though made of good old *Linseed Oyl*, Fat and Smeary, and hinders its *Drying;* so that when it comes to the *Binders* it also *Sets off.*

" *Thirdly*, They do not use that way of clearing their *Inck* the *Hollanders* do, or indeed any other way than meer Burning it, whereby the *Inck* remains more *Oyly* and *Greasie* than if it were well clarified.

" *Fourthly*, They to save the *Press-man* the labour of *Rubbing* the *Blacking* into *Varnish* on the *Inck-Block*, *Boyl* the *Blacking* in the *Varnish*, or at least put the *Blacking* in whilst the *Varnish* is yet *Boyling-hot*, which so *Burns* and *Rubifies* the *Blacking*, that it loses much of its brisk and vivid black complexion.

" *Fifthly*, Because *Blacking* is dear, and adds little to

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the weight of *Inck*, they stint themselves to a quantity which they exceed not; so that sometimes the *Inck* proves so unsufferable *Pale*, that the *Press-man* is forc'd to *Rub* in more *Blacking* upon the *Block*; yet this he is often so loth to do, that he will rather hazard the content the Colour shall give, than take the pains to amend it: satisfying himself that he can lay the blame upon the *Inck-maker*.

" Having thus hinted at the difference between the *Dutch* and *English Inck*, I shall now give you the Receipt and manner of making the *Dutch Varnish*.

" They provide a *Kettle* or a *Caldron*, but a *Caldron* is more proper. This Vessel should hold twice so much *Oyl* as they intend to *Boyl*, that the *Scum* may be some considerable time a *Rising* from the top of the *Oyl* to the top of the Vessel to prevent danger. This *Caldron* hath a Copper Cover to fit the mouth of it, and this Cover hath an Handle at the top of it to take it off and put it on by. This Caldron is set upon a good strong Iron *Trevet*, and fill'd half full of old *Linseed Oyl*, the older the better, and hath a good Fire made under it of solid matter, either *Sea Coal*, *Charcoal* or pretty big Clumps of Wood that will burn well without much Flame; for should the Flame rise too high, and the *Oyl* be very hot at the taking off the Cover of the *Caldron*, the fume of the *Oyl* might be apt to take Fire at the Flame, and endanger the loss of the *Oyl* and Firing the House: Thus they let *Oyl* heat in the *Caldron* till they think it is Boyling hot; which to know, they peel the outer Films of an *Oynion* off it, and prick they Oynion fast upon the end of a small long Stick, and

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so put it into the heating *Oyl*: If it be Boyling-hot, or almost Boyling-hot, the *Oynion* will put the *Oyl* into a Fermentation, so that a Scum will gather on the top of the *Oyl*, and rise by degrees, and that more or less according as it is more or less Hot: But if it be so very Hot that the Scum rises apace, they quickly take the *Oynion* out, and by degrees the Scum will fall. But if the *Oyl* be Hot enough, and they intend to put any *Rosin* in, the quantity is to every Gallon of *Oyl* half a Pound, or rarely a whole Pound. The *Rosin* they beat small in a *Mortar*, and with an Iron Ladle, or else by an Handfull at a time strew it in gently into the *Oyl* lest it make the Scum rise too fast; but every Ladlefull or Handfull they put in so leasurely after one another, that the first must be wholly dissolved before they put any more in; for else the Scum will Rise too fast, as aforesaid: So that you may perceive a great care is to keep the Scum down: For if it Boyl over into the Fire never so little, the whole Body of *Oyl* will take Fire immediately.

" If the *Oyl* be Hot enough to *Burn*, they *Burn* it, and that so often till it be *Hard* enough, which sometimes is six, seven, eight times, or more.

" To *Burn* it they take a long small Stick, or double up half a Sheet of Paper, and light one end to set Fire to the *Oyl*; It will presently Take if the *Oyl* be Hot enough, if not, they Boyl it longer, till it be.

" To try if it be *Hard* enough, they put the end of a Stick into the *Oyl*, which will lick up about three or four drops, which they put upon an Oyster shell, or some such thing, and set it by to cool, and when it is

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cold they touch it with their Fore or Middle-Finger and Thumb, and try its consistence by sticking together of their Finger and Thumb; for if it draw stiff like strong *Turpentine* it is Hard enough, if not, they Boyl it longer, or *Burn* it again till it be so consolidated.

" When it is well Boyled they throw in an Ounce of Letharge of Silver to every four Gallons of *Oyl* to Clarifie it, and Boyl it gently once again, and then take it off the Fire to stand and cool, and when it is cool enough to put their Hand in, they Strain it through a Linnen Cloath, and with their Hands wring all the *Varnish* out into a Leaded Stone Pot or Pan, and keeping it covered, set it by for their use; The longer it stands by the better, because it is less subject to turn Yellow on the Paper that is Printed with it.

" This is the *Dutch* way of making *Varnish*, and the way the English *Inck-makers* ought to use.

" *Note*, *First*, That the *Varnish* may be made without *Burning* the *Oyl*, viz. only with well and long Boyling it; for *Burning* is but a violent way of Boyling, to consolidate it the sooner.

" *Secondly*, That an *Apple* or a *Crust* of *Bread*, *&c.* stuck upon the end of a Stick instead of an *Oynion* will also make the Scum of the *Oyl* rise: For it is only the Air contained in the Pores of the *Apple*, *Crust* or *Oynion*, &c. pressed or forced out by the violent heat of the *Oyl*, that raises the many Bubbles on the top of the *Oyl:* And the connection of those Bubbles are vulgarly called *Scum.*

" *Thirdly*, The English *Inck-makers* that often make *Inck*, and that in great quantities, because one Man

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may serve all *England*, instead of setting a *Caldron* on a *Trevet*, build a *Furnace* under a great *Caldron*, and Trim it about so with Brick, that it boils far sooner and more securely than on a *Trevet;* because if the *Oyl* should chance to Boyl over, yet can it not run into the Fire, being Fenced round about with Brick as aforesaid, and the *Stoking-hole* lying far under the *Caldron.*

"*Fourthly*, When for want of a *Caldron* the *Master-Printer* makes *Varnish* in a *Kettle*, He provides a great piece of thick *Canvass*, big enough when three or four double to cover the *Kettle*, and also to hang half round the sides of the *Kettle:* This *Canvass* (to make it more soluble) is wet in Water, and the Water well wrung out again, so that the Canvass remains only moist: Its use is to throw flat over the Mouth of the *Kettle* when the *Oyl* is *Burning*, to keep the smoak in, that it may stifle the Flame when they see cause to put it out. But the Water as was said before, must be very well wrung out of the *Canvass*, for should but a drop or two fall from the sides of it into the *Oyl* when it is Burning, it will so enrage the *Oyl*, and raise the Scum, that it might endanger the working over the top of the *Kettle.*"

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Practical Observations on the Preparation of Printing Ink as given by Moxon in the Mechanick Exercises.

Moxon observes that too great a quantity of rosin makes the Ink turn yellow. My opinion is decidedly contrary to this statement: I should say, that too great a quantity of rosin would make the Ink too strong to be worked with, but that in proper proportion in combination with the oil it forms a varnish, by thickening the oil, and prevents its spreading in the paper and thus turning yellow; this combination possesses a viscidity which confines the oil to the Ink, and prevents its extending beyond the surface of the impression, and thus preserving the beauty of the printing, a quality which could not be obtained without the rosin, except with a great sacrifice of time in the preparation of the oil, and also a great diminution of the quantity, even if it could then be obtained.

The direction is good respecting the burning of the oil; it is preferable to set fire to it as soon as it will light, and occasionally to extinguish it

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for the purpose of trying its consistence; by thus repeatedly setting fire to the oil and extinguishing it, it can be prepared to any degree of strength, is more manageable, and is less liable to accidents.

I have strong doubts as to putting litharge of silver into the oil; whatever the preparation was that was used under that name, it must have been expensive;—if it was to act as a drier, that quality might have been much better obtained by boiling and burning the oil to a greater degree, and by the use of rosin.

Moxon says "That the *Varnish* may be made without *Burning* the *Oyl*, viz. only with well and long Boyling it;" &c. — I have boiled linseed oil for five hours, till it was considerably thickened, and drew out in strings; the Ink that was made with it worked very well and clean, but after a few days the oil sank through the paper and stained the back of it, so as to disfigure it a great deal, and thus rendered the Ink unfit for book work.

The result of my experiments proved to me, that boiling alone, however long continued, is not sufficient; and that unless the oil be set fire to and burnt it cannot be brought to a proper state for making good Printing Ink.

Moxon mentions that an onion or a crust of

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bread is used to ascertain if the oil be near the boiling point of heat: it will be observed in the more modern receipts that the onion is stated to be used for a different purpose—to absorb the grease from the oil.

I have always found that a tin cover made to fit the top of the boiler closely, was sufficient to extinguish the flame almost instantaneously, without the addition of a wet cloth, which is a dangerous article to use with boiling oil.

I am decidedly of opinion, that an Ink made according to the directions given in this receipt, which Moxon praises so highly in his work, could not be used in the present state of the printing business:—it would accumulate and dry upon the face of the balls or rollers, and make them so hard as to render them unfit for use; it would also accumulate on the face of the type so as to clog it up, and cause it to require washing frequently, to the great delay of business and loss of time to the pressmen, besides the waste of paper, as some sheets would unavoidably be spoiled after each washing before they could again get into a regular train of working; and when this was done the same process must be renewed, so that they would never be able to produce good and uniform work without an immense sacrifice of time.

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Colouring matter, which is an important article in Printing Ink, is not mentioned in this receipt, either as to the material, the quality, or the quantity. Moxon, indeed, in his preliminary observations, seems to hint that the pressmen rubbed the blacking into the varnish on the ink-block, and censures the English Ink-makers for the small quantity of black they put into their Ink, and seems to imply that it was an innovation to have the Ink prepared ready for use. At present pressmen would not be allowed, on any pretext whatever to alter the Ink for any continued work, by adding either varnish or colouring matter.

Moxon says that the Hollanders exhibited patterns of good printing to all the world; but he was then speaking of them more particularly in comparison with the English; and whoever will take the trouble of looking at the productions of the English press about the middle of the seventeenth century must allow that the workmanship had greatly degenerated, and that it was then at its lowest state, and the productions of the Dutch press were much superior; but if the productions of the Dutch press of that time are compared with works printed in England within the last forty years,

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it will appear that the Ink is decidedly inferior in a very great degree. — Taking into account colour, consistency, and foulness in working, this boasted Ink would now be deemed worthless.

It will be observed that Moxon in this receipt states that the Dutch "let *Oyl* heat in the *Caldron* till they think it is Boyling hot; which to know, they peel the outer Film of an *Oynion* off it, and prick they Oynion fast upon the end of a small long Stick, and so put it into the heating *Oyl:* If it be Boyling-hot, or almost Boyling-hot, the *Oynion* will put the *Oyl* into a Fermentation, so that a Scum will gather on the top of the *Oyl,* and rise by degrees, and that more or less according as it is more or less hot." Fertel, the next in order, directs a crust of bread to be put into the hot oil, for the purpose of taking away the grease from it; and Breton's receipt gives quite a different reason for using the onion from Moxon; he says, "the instant that your oil becomes warm throw into the oil a pound weight of dry crusts of bread and a dozen onions, these things absorb the grease of the oil." Lewis, however, who founded his experiments on Breton's formula, expressed a doubt of the utility of these articles; yet subsequent writers have directed them to be

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used to absorb the grease. I have no hesitation in asserting, from my own practice, that they are useless in both points of view. A little experience will enable a person to judge when oil is near boiling, from the different appearances that the surface assumes, when it is near the boiling point; and his caution will induce him timely and repeatedly to try if it will take fire, which is the best and safest criterion: as for Fertel and Breton's object for introducing onions and crusts of bread to absorb the grease in the oil, if I am correct in my view of the subject, they cannot be of any possible utility, for I deny the presence of grease in an expressed vegetable oil; and even if, by any accident or by design, grease were present, I have yet to learn that the affinity of the crust and onions for the grease would be greater than for the oil, so as to combine with the one in preference to the other; and all the effect that I can conceive could be produced, would be that the crusts of bread and the onions would absorb a portion of the oil, which would thus be wasted.

I have made considerable quantities of Printing Ink at different times, and of various qualities; I never introduced either onions or crusts of bread into the oil, nor did I ever

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discover any evil effects from this dreaded grease: I have by me printing that was executed with Ink of my making many years ago, which has undergone no change in its appearance, no spreading at the edges of the types, no staining the paper at the back of the page, which would undoubtedly have taken place if grease had been present in the oil.

I find no information as to the manner in which Moxon obtained the Dutch process of making Printing Ink, but the most natural surmise is, that he obtained it through the medium of private connexion; considering that the jealous secrecy which has always been observed by the few who possessed knowledge on the subject prevented them from laying open the result of their own practice to the world. I am the more confirmed in this opinion as I know of no books on the subject antecedent to his own, and he has become the standard of all succeeding writers.

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FERTEL'S *Method of preparing Printing Ink and Lamp Black. Translated from his Work on Printing.* 1723.

Of the Manner of making Varnish for the Composition of Printing Ink.

Printing Ink is composed of two things; namely, of varnish and of lamp black. To make this varnish we must take an iron or a brass pot; there are some made expressly for the purpose, large at the bottom, and narrow at the top, with handles on each side, to pass a stick through, to carry it from one place to another. The cover of this pot ought to be well adjusted, in order to stifle the fire which may be caught by the oil within.

We ought to fill the pot a little more than half full of oil, for if we put more in than this there is a danger of its overflowing into the fire, because the oil always increases in measure as it becomes warm. We ought to pay particular attention to this point, for fear of some misfortune happening, as we shall speak of after.

There are but two sorts of oil which are proper for making varnish; namely, linseed oil and nut oil; all the others are nothing worth, being too greasy, which makes the impression macule, when it receives the pressure, and turn yellow as it grows old: however I have sometimes used rape or hemp oil, but it has been in the printing of almanacks and other such works, in which we were not

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anxious to make the impression fine, as they were published at a low price; and we have not printed many of these sorts of works.

Having thus filled the pot with the quantity of oil which we have said, we make a clear fire under it, the same as for soup, until the oil becomes warm and inflammable; that is to say, about two hours or thereabouts.

In the commencement we throw in a crust of bread, in order to purify the oil from the grease, which we ought to take away after it is converted into charcoal, and as soon as it is withdrawn we ought to suffer the fire to decrease, whether it be of wood or charcoal, but we ought to continue the preparation over a little fire for the space of three hours or thereabouts; after which time, for knowing if the oil be sufficiently done, we take a little out with an iron spoon, and drop it on a slate or tile, and as soon as these drops become cool, we touch the oil with our fingers, and if it is gluey, and draws out like weak glue in threads between our fingers, it is an evident mark that it is sufficiently done, and that it changes its name of oil into that of varnish; if it has not this effect, we ought to leave it over the fire until it affords these signs.

The varnish being thus made, we leave it to cool in the same pot until the following day, when we empty it into another vessel, in which we make the Ink.

As it may happen that the varnish may be too strong to make the Ink in winter, we ought, as a precaution, to draw off a pot of more or less quantity, according as we may want, an hour after we have taken out the crust of bread, in order that we may have some to

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weaken that which would afterwards be too strong; and this serves also for printing engravings on copper plates.

We ought however to remark, that the oil which we draw off is sufficiently done, for if it is not, the impression turns yellow, is rendered sticky, and discharges in the reiteration; we perceive this in cases where the balls do not cling together, and it is a fault to which we ought to attend.

As it may happen that the fire may catch the oil, and most probably when its change into varnish is commencing, we must take the following precautions:—

As soon as we have put our pot of oil over the fire, we ought to take some folds of coarse cloth, and having soaked them in water, and folded them into four or five thicknesses, and well wrung them, we leave them to drain, in order that when we would use them, no water may be dropped into the oil, which might cause it to overflow and catch fire. We ought to have a stick ready to carry the pot, in case it should catch fire, in order that we may not have necessary things to look for when it happens, for fear the fire should augment too much to be extinguished.

When we see that the oil becomes much heated, and is in danger of overflowing the pot, or when the oil has caught fire, we ought immediately to place the cover on the pot, pass the stick through the handles, and carry it into the court; if it be in a garden that we boil the oil, we must then transport it a little way from the fire, taking care to preserve our presence of mind, and without fear to carry it in a manner that the flame which

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may rise through the crevices round the cover, may not injure those who carry; and we ought to place it softly on the ground, for fear of overturning.

When we have thus placed the pot on the earth in an even place, we ought to take away the cover with a stick, for fear of being burnt by the flame, and leave the oil burning boldly; but if we see that it is inclined to overflow the pot, we must immediately replace the cover; if that is not sufficient to extinguish it, we can throw our folds of cloth over it, in a manner to exclude the air, and leave it thus until we see a thick black fume rising around the pot, which may be in less than half a quarter of an hour; by this precaution we escape the risk of being burnt and of overturning our pot, as has happened to many workmen, for want of this foresight.

There are printers who maintain that it is necessary to put turpentine into the oil, saying that it renders the Ink stronger, prevents the impression from discharging, and makes it dry sooner: all this is incontestable, but does not take into consideration the accidents which it may cause, and which we now consider.

1st. When we do not succeed in preparing the turpentine exactly as it ought to be for mixing with the oil, it renders the varnish so strong and thick that it tears the paper upon the letters of the form, and they are thus stopped up in a very little time.

2d. Whenever the turpentine is done as it ought to be, it is sufficient to say that it is a matter resembling a strong liquid paste which is full of little grains of sand, which never mix with the varnish, but rest at the bot-

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tom of the pot; of course when we use this varnish we ought not to be astonished if all these little grains fill quantities of the letters of the form.

3d. The turpentine attaches so strongly to the characters that it is almost impossible to wash the form well, so that when we come to distribute the letters we see the Ink again all the length of the pages, upon the signatures, and upon the quadrats, the same as though it had not been washed; it is this which fills also insensibly the eyes of the characters, for the Ink continuing to dry little by little, in a short time clogs up the letter, and renders it unfit to remain in the fount.

See then the reasons of its unfitness for this service, and I maintain, I speak from experience, that when an oil is well prepared, it dries as well as when there is turpentine in it, without the fear of causing those accidents of which I have spoken, and of which I have seen the effects.

If, however, we use an oil newly made, it is certain to macule the impression, and in that case we must put a sixth part of turpentine, which we do in the following manner.

The turpentine is done in a separate vessel, and absolutely ought to be prepared in an open court, because it takes fire so very easily, and is so extremely difficult to extinguish. When the turpentine has been upon the fire for the space of two hours or thereabouts, we dip a small piece of paper in, and if, as soon as it is dry, the turpentine rubs off from the paper like dust, leaving none of itself attached to it, it is a proof that it is sufficiently done. We then take away the vessel in which is

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our varnish a little distance from the fire, and add our turpentine to it. We mix it into the varnish with an iron spoon for a sufficient time, after which we replace the varnish on the fire for the space of a quarter of an hour, stirring with the spoon from time to time, in order that the varnish may be well mixed with the turpentine.

Those who would not make use of turpentine, for the reasons which we have cited, must make their provision of oil from one year to another, for the older it is, the sooner it is prepared, and by this precaution it is not subject to macule the impression.

Of the Manner of making Smoke Black, and mixing it with the Varnish, to make Printing Ink.

Smoke black is the fume of pitch resin confined in a little chamber well closed, and hung round with sheep skins, from which we afterwards shake it off; but as it is dangerous to have the fire in a house, it is more proper to make the black in a tent, a little removed from the house, under a roof of tiles.

Those who are continually employed in making smoke black call this tent a *Sac-à-noir:* it is constructed of four little rafters, of three or four inches square, and of seven or eight feet high, supported by two traverses of wood on each side; namely, one at the top and one at the bottom, the same as in a bedstead, with a little door for entering in stooping a little.

We can make the *sac-à-noir* thus when we please; the top of the *sac* is plank, and ought to be well jointed; there are some who make the floor of planks, but for fear

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it should take fire it is more convenient to pave it with square tiles, well joined. After this we fasten all round the four rafters some cloth which we stretch as tight as possible, with little nails two inches distance from each other, observing to close most carefully the vents on every side; this done, we paste sheets of strong paper over all the cloth, and the same over the joints of the planks, and all round the border of the base, in order that the fume may not escape, knowing that it is this fume which makes the black.

The *sac-à-noir* being thus arranged, we take an iron vessel, in proportion to the size of our *sac*, for fear of setting it on fire, which vessel we fill with pitch resin to nearly an inch of the brim, which pitch we break into pieces about the size of an inch.

Having thus filled our vessel with the pitch resin, we place it in the middle of the *sac-à-noir*, and set fire to it with paper; when it is well lighted we shut the door, which ought to be well adjusted; but in case there passes any of the smoke through the joints, we ought to close them well, either with paper or cloth.

When the resin shall be entirely consumed, and all the fume attached to the *sac-à-noir*, (which we can know by feeling when the *sac* is entirely cold,) we must beat it all over on the outside, in order to make the smoke black, which is attached to it within, fall down.

When all the black is fallen on the pavement, which will be in about half a quarter of an hour, we can open the door and collect the black into a heap with a broom, to put into some proper vessel; and, again refilling the pot with resin, repeat the operation as we have described.

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We can, however, continue to burn the pitch resin as many times as we please without it being necessary to beat down the black upon the floor at each time that we put fresh resin into our vessel.

We ought always to use the precaution of covering our vessel before we beat the *sac*, to prevent the black from falling within.

Sometimes it happens, that, when we collect the black on the pavement with our broom, we find mixed with it particles of sand, gravel, or other such thing, injurious to it; in this case we must put the black in a vessel in which is some water; by this means all the dirt sinks down and rests at the bottom of the water, and the black remains at the top. It is thus that smoke black is made for the use of our profession.

Of mixing the Black with the Varnish.

To mix the smoke black with the varnish, we must empty the varnish into a little vessel in which we put our smoke black, for all other black is worth nothing for printing, and the lighter it is the better; the more we put into our ink, the thicker it is, wherefore we must not put in more than is necessary: it must then be mixed together extremely well with a stick, made expressly for the purpose, in order that the black may be well mixed with the varnish until it is brought to resemble a *bouillée*, when we withdraw it from the fire; and every time that we use it we must, when we put it on the ink table, be careful to grind it well again.

We ought to observe that our ink table is perfectly

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clean before we put our Ink upon it, because there generally rests upon it a quantity of dust, hair, little pieces of wool, or other such things, arising from the balls, which prevent a clean impression, and cause a great drawback on the neatness of quantities of letters of the form, which are often choked up for want of this precaution.

When it is necessary to make the Ink on the ink table of the press, we generally put five ounces of smoke black to two pounds of varnish, of sixteen ounces; but we cannot be always so precise, as the black is not always of the same weight, or when the varnish is more or less thick; for a greater certainty we ought to have two different measures, one for the varnish and the other for the black, when we have ascertained the precise quantity of each, which we must keep expressly for the purpose, which is a necessary precaution; we may then ensure the certainty that the Ink will be of equal thickness and of equal blackness.

Having thus put upon our ink table the quantity of black and varnish contained in the measures, we must grind them in the manner which we have said. It is in this manner that we ought to mix the smoke black with the varnish, to have an Ink always equally black.

Red Ink.

We use the same varnish for making red Ink as for black, except that it ought not to be so strong, and that we substitute cinnabar, otherwise called vermilion, for the black, which ought to be well ground upon a marble,

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(this is to be understood when it is in stone,) in the same manner as the black.

We may add a small piece of isinglass, about the size of a nut, which we have steeped twenty-four hours in a little brandy, and which we must well mix with the varnish and the red; this renders the Ink more brilliant, as we have observed.

We ought to grind this Ink every morning and afternoon, the same as when first made, in order that the red and the isinglass may be well mixed with the varnish.

There is generally a crust formed on this Ink when it has been some time out of use, for hindering which we must cover the Ink with water, the table being a little inclined, in order that the water may not flow out; which water we throw off when we come to use our Ink, and grind it in the usual way. This is the best method which we can employ for making red Ink.

Speaking of the black in use for copper plates, the heaviest is the best, contrary to that employed in printing. The following is the method of its manufacture.

We must have some of the lees of wine, well dried, and burnt in the middle of the fire, and when reduced to charcoal extinguish it in water, and crush it the same as the vermilion; after which we mix it with the varnish, observing that the Ink ought to be much more liquid than that which we use in our own profession.

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Observations on Fertel's Method of making Printing Ink.

I would recommend that the pot should never be half full, to prevent danger and mischief if the oil by over-heating become unmanageable; for it is not by its increasing in measure as it becomes warm that the danger arises, but by urging the fire to bring the oil to a state of boiling too rapidly, or, when it becomes inflammable, by letting it burn too long: in the first case it will take fire spontaneously from its great heat, and in the other it accumulates so much heat by burning, that in both instances it is unmanageable, becoming a body of froth, rising and overflowing the pot in a complete mass of raging liquid fire, and setting all attempts to extinguish it at defiance.

Fertel directs that a crust of bread should be thrown in at the commencement of the process, for the purpose of absorbing the grease. It is curious to observe the progress of this crust of bread, and of the onions; with Moxon, in the Dutch method, they are, one *or* the other, or an apple, for the purpose of ascertaining when the

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oil is near the boiling point; with Fertel it is a crust of bread to take the grease out of the oil; with Breton, and subsequent writers who have copied from him, it becomes crusts of bread *and* onions for the same purpose.

This writer is the first, apparently, who directs that two sorts of varnish should be made; one weak, the other stronger, to suit different seasons. I look upon this statement as worse than fallacious, for it misleads, and if followed would cause the varnish to be of an inferior quality, for it cannot be prepared of the best quality by a less degree of boiling; it may be produced thinner, but the oil would always separate from the colouring matter and stain the paper. In fact, if the oil be not brought to a proper consistence by boiling and firing to make varnish for Ink of a good quality, it must be insufficiently prepared, and will produce Ink of an inferior quality.

Some printers, Fertel says, put turpentine into the oil, to render it stronger. They certainly took a great deal of trouble in preparing it, and that also in an expensive manner, by reducing turpentine to the state of rosin, when rosin would have been cheaper, and would have answered the same purpose, without the trouble and danger of preparing it. He says it is full

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of little hard grains, as of sand, which can never be ground up. This induces me to think that the oil did not boil when the turpentine was put in, and that they were deceived by appearances; otherwise it would have been completely melted by the heat of the oil. *See* Chap. IV. On preparing Varnish.

The proportion of lamp black is much too small for good Ink, or even for Ink of a tolerable quality; but this will be more particularly perceived where I treat of making Ink. Where it is necessary to make lamp black, I believe that the directions given in the French receipts will be found satisfactory.

A great deal of trouble invariably attends printing with red Ink, as printers have never been able to make it work clean. To prevent unnecessary repetition I shall refer the reader to Chapter V. On Coloured Inks, where, under the article Vermilion, directions are given for making it work as clean as black Ink.

Fertel was a French printer at Saint Omers, and is the next writer to Moxon whom I meet with; he published a practical work on printing in 1723, in quarto, in which he gives directions for making Printing Ink, and also for making smoke black, of which the preceding is a translation. When the other French receipts are

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examined, it will be perceived that they are little more than copies of this; even Breton ceases to be original in his article on this subject in the Encyclopédie; and as Lewis made his experiments from Breton's memoir, and all English writers subsequently having quoted Lewis as their authority on this subject, Breton, however incorrectly, has uniformly appeared as the original author of all the methods of making Printing Ink published in England, with the exception of the article in the Encyclopædia Britannica.

Fertel's work I have reason to believe is a scarce book; I never saw another copy than that from which I made the preceding extract, which belongs to Mr. Bentley, nor did I ever see it mentioned in any works on printing: the title of it is, "La Science Pratique de l'Imprimerie. Contenant des Instructions trés-faciles pour se Perfectionner dans cet Art," &c. A Saint Omer, par Martin Dominique Fertel. MDCCXXIII.

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The Method of preparing Printing Ink, by M. BRETON, *Printer to the King of France. Translated from the Encyclopédie Méthodique.* 1751.

Black Ink used for Printing.

The Ink that is used for printing books is a mixture of oil and black. The oil is converted into varnish by boiling; and the black is extracted from pitch-resin. We call artists all the parties who extract the smoke of that sort of pitch when it is burnt, in a building constructed expressly for the purpose, named in the profession *sac-a-noir*, of which article we shall write in its order.

The vessel in which we make the varnish for printing is constructed of iron, cast iron, or of copper—of the last metal it is made generally—in form of a pear, and we name it thus. The others are simply of the figure and form of a common cauldron. Of whatever material may be the vessel, and of whatever form, it ought to have a copper cover, with which we can at will shut it up very exactly. The body of the vessel should have two handles of iron, a little higher than the level of the cover, which has also the same; these handles serve to pass one or two sticks through, by means of which a man at each end may, without risk, carry and transport

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the vessel when we would withdraw it from the fire, or replace it thereon.

For precaution against all the accidents that might happen, it is prudent, in making this varnish, to choose a spacious place, such as a garden, and to avoid the vicinity of buildings.

If we would make one hundred pounds of varnish, we must allow for the reduction by putting into our pear or cauldron a hundred and ten or a hundred and twelve pounds of nut oil; observing that the vessel is not more than two thirds full, to allow for the expansion of the oil, which encreases in measure as it becomes warm.

The vessel being in this state, closed very exactly, must be placed upon a clear fire for the space of two hours. This first time given to the preparation procures a degree of heat. Take it off the fire, and if the oil be inflammable, as it ought to be, it will take fire; if it does not take fire of itself, it must by management. Leave your oil burning some time, then fill up the crevices round the cover with several little pieces of old linen or stuff soaked in water; and this must be repeated different times.

When the fire decreases, uncover the vessel with the iron spoon; this must be often repeated, as on it depends, in a great measure, the success of the operation. This done, replace the vessel upon a less lively fire, and the instant that your oil becomes warm throw into the oil a pound weight of dry crusts of bread and a dozen onions, these things absorb the grease of the oil: cover the vessel again, and leave it boiling over a very little fire three hours consecutively, or thereabouts; in that space

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of time the oil ought to arrive at a degree of perfection; for knowing this assuredly, you take out a little with an iron spoon, and drop it upon a slate or tile: if the oil cools like glue, and draws out in threads like weak glue, it is an evident proof that it is sufficiently done, and that it must change its name of oil into that of varnish.

The varnish being thus made, it ought to be transferred into vessels intended for its preservation; but before it loses its warmth it must be passed many times through fine linen, or through a straining bag made expressly for the purpose, in order that it may be perfectly clear.

We ought to have two sorts of varnish: the one weak, for cold weather, the other stronger, for the warm. This precaution is indispensable; for it often happens that we are obliged to modify the quantity of the one by that of the other.

The weak varnish can be made at the same fire as the strong, but in a separate vessel: we can thus employ, and it is my advice, for this varnish linseed oil; because that in preparing it keeps a clearer colour, and clogs less, than nut oil, which renders it more proper for red Ink, of which we are going to speak.

This weak varnish, for its perfection, requires the same care and precaution as the stronger: all the difference consists in giving it a less degree of fire, but managing it in such a manner as that it may acquire proportionately the good qualities of the strong:—it being less done, less thick, and less gluey than the last.

If it be wished to make the weak varnish of the same nut oil which has been used for the strong varnish, there is but small inconvenience, when it is to be used for

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making the red Ink, or to spare the pains of making it separately and of different oil; it is simply to seize the occasion of the first boiling of the other, and, on the instant when it is perceived to have acquired all the requisite qualities, to draw off the desired quantity from that which is left upon the fire.

Linseed and nut oils are the only proper ones for making good varnish for printing; that of nuts merits the preference in every respect. As to the other sorts, they are of no value, because the grease cannot be perfectly separated from them; and they sometimes macule the impression in the printing, and make it turn yellow as it grows old.

However, in some printing, we use rape or hemp oil; —but it is for printing low priced pamphlets;—that management is however of little consequence which is proper only for bad merchandize.

There are some printers who believe that it is necessary to put turpentine into the oil, to render it stronger, and in order that it may dry the sooner. It produces these effects, but there are a number of inconveniences resulting from it. The first difficulty is, of doing it so precisely that it does not too much thicken the varnish, which is so strong and so thick already, that it glues the paper upon the form, and wrinkles it much in a little time. If the turpentine is done to its point, it forms a paste, liquid enough, but full of little hard grains, as of sand, which can never be ground up.

The turpentine, and in the same manner the litharge, which some persons use, and which they consider a valuable secret, have again the fault of attaching so strongly

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to the characters as to make it almost impossible to wash the forms well, however warm may be our lie; besides, they dry and harden so quickly that damage is done in the distribution of the letters, so many of them are fastened together; the eyes of the letters are blocked up without hope of being cleared, which makes the characters of little service, and which causes a grievous deficiency in a fount.

In cases where, through want of due precaution, newly made oil is employed for making the varnish, turpentine must be used, because, without it the impression will inevitably macule. In this case we may put a tenth part of turpentine, which we have separately prepared at the same time and in the same place with the varnish, and with the same precautions. It must then be boiled for six hours, or thereabouts. For knowing when it is sufficiently done, a morsel of paper must be dipped into it, and if, as soon as it is dry, it will break clean and smooth, without any thing resting attached to the paper, the turpentine is sufficiently done.

The turpentine must now be poured into the varnish while the vessel is off the fire, and stirred in with an iron spoon: it must then be replaced on the fire for the space of half an hour or more, without ceasing to stir it, in order that the varnish may be well mixed with the turpentine and litharge. This, or nothing but using old oil, can prevent these inconveniences.

The *sac-a-noir* is constructed of four little rafters, of three or four inches square, and seven or eight feet high, supported on each side by two traverses;—but these dimensions always depend on the will of him who constructs;

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—the top is formed of planks well jointed and well closed. The bottom or ground floor, for greater surety and propriety, ought to be paved or tiled; reserving a space in that little chamber for a door at the base, for entering and departing. All the inside of the chamber must be hung with linen cloth, new, and of a close texture, stretched as much as possible, with nails put at the distance of two inches from each other: that done, you paste over all your cloth some very strong paper, and pay attention to stop up all the light which you perceive, in order that the smoke may not in the least escape. A *sac-a-noir* thus hung is sufficient; but it is more durable, more close, and much more exact, hung with sheep skins well stretched.

It is in the *sac* that we burn the pitch-resin from which we extract the smoke black. To accomplish this we prepare a quantity of pitch-resin, and make it boil and melt, in one or several pots according to the quantity. Before it is cool we stick in several slips of paper or brimstone matches, place the pots in order in the middle of the *sac*, and, last of all, we put the fire to these matches, and shut the little door exactly in going out.

The pitch-resin being consumed, the smoke becomes attached to all parts of the interior of the *sac-a-noir;* and when the *sac* is cold you go in, cover the pots and reclose the door, the exterior must then be beat all round with sticks, to make the smoke black fall, when you collect it into a heap, and put it into a vessel either of earthenware or any other. As it is swept up with a broom, and there mixes with it some particles of dust,

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we must use the precaution of putting a quantity of water at the bottom of the vessel, and, when they precipitate, the black must be taken off with a skimmer, or at least some other precaution must be resorted to before putting it into the vessel proper for its preservation.

Smoke black is without contradiction the best that one can employ for Printing Ink; two ounces and a half of black is put to each pound of varnish; I suppose the pound of sixteen ounces. However the eye determines by the tinct of the Ink the quantity of black.

For mixing well the smoke black with the varnish, it is necessary to be very attentive in mixing it together a little at a time, or gradually; and of mingling it each time in such a manner that the whole may form a thick paste, which will produce a great many threads when it is divided into parts.

It is the custom of some printers to mix the smoke black with the varnish upon the ink table, judging by the eye of the proper quantity of each article. I do not see in this composition of the Ink any inconvenience, unless it is the fear that the Ink will not be equally mixed, because it requires some time; or that the Ink thus made by different hands would not be of one equal tinct in the same printing; from whence I infer, that it would be better to have the Ink equally prepared, without relying too much on the journeymen.

Red Ink used in Printing.

This Ink is used very frequently, and is almost indispensable in impressions of prayer books, almanacks, and

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other religious books; sometimes for posting bills, and elegance in title pages.

The weak varnish is the best to be employed for red Ink. It ought to be made of linseed oil, strong and new, because it does not blacken in preparing, like that of nuts; and the varnish cannot be too clear. We supply the place of smoke black by carmine, or vermilion, well dried, and ground as fine as possible. A small quantity of the varnish must be put on an ink table, reserved for that use alone, and some vermilion thrown upon it; this must be mixed and crushed with the muller, and then removed with the palette knife from the ink table. This manœuvre must be repeated many times, until you suppose that you have used a pound of varnish and half a pound of vermilion.

Many persons mix in the first composition three or four spoonfulls of common spirits of wine or brandy, in which has been dissolved a piece of isinglass, about the size of a nut, four and twenty hours before, but I have found from experience that this mixture does not accomplish our aim; it being more certain to add to the given quantity of red Ink a dram and a half of carmine: it rectifies the colour of the vermilion, which is not often so perfect as we desire; it adds spirit to it, and prevents it from tarnishing. It is more expensive, but more satisfactory. You must then recommence grinding the Ink, in a manner that ought not to be too gentle; as strong Ink is very apt to glue up the eye of the letter.

If you do not consume all the red Ink which you have made, for its preservation place your ink table on

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the edge, and cover it with water, in order that the vermilion may not dry, nor a scale form on the surface of the varnish, which can never be separated from it, and which is the effect of the sun and dryness.

Other Inks of different Colours.

Although we generally employ but the two sorts of Ink of which we have spoken, we can make Ink of different colours, by substituting for the smoke black and the vermilion the necessary ingredients which produce different colours. We may, for example, make Green Ink with verdigrise, calcined and prepared; Blue with prussian blue, also prepared; Yellow with orpiment; Violet with fine lake, calcined and prepared; and mixing these colours with the varnish, with the same care as the red Ink. The preparation of the verdigrise, the prussian blue, the lake, &c. consists in mixing with them some white lead, to render them clearer; without which these colours are too dim by candlelight.

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Practical Observations on M. Breton's Method of preparing Printing Ink in the French Encyclopédie.

I have been more particularly induced to give this method of preparing Printing Ink by M. Breton, Printer to the King of France, as subsequent writers have availed themselves of it; and it has become a standard receipt, without being acknowledged in all cases; and also from being in a voluminous and expensive French work it is not of easy general reference.

The manner prescribed for boiling the oil is similar to Moxon's, and does not require any additional observations.

It is evident that the cover M. Breton used for his vessel in which he boiled the oil did not "shut it up very exactly," as he recommends; for he afterwards directs that the crevices round the cover should be filled up with several little pieces of old linen or stuff soaked in water. I mention this for the purpose of cautioning most earnestly those who have to superintend the boiling of oil to be careful that not a drop of

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water gets into the vessel while it is boiling, as it may be attended with the most hazardous consequences. Moxon's method is less dangerous, as he directs to use a large piece of cloth with the water wrung out, and to hang over the cover down the sides:—both methods are attended with danger, and both are unnecessary.

M. Breton also directs crusts of bread and onions to be put into the oil after burning it, but for a different purpose from that assigned by Moxon. They are now introduced to absorb the grease; and I must acknowledge that for this object I could never perceive their utility, for I have always understood grease to be an animal substance, and of course it cannot be present in an expressed vegetable oil. In boiling linseed oil to make varnish for Printing Ink I hold these articles to be useless; and their power of absorbing grease from oil, I look upon as apocryphal.

M. Breton speaks of replacing the vessel upon a less lively fire, and continuing the boiling: as the fire must be a steady brisk hot fire to raise the oil to the boiling heat, which is about 600° of Fahrenheit's thermometer, while lead melts at 540°; it may easily be conceived that if the fire slacken the oil will cease to boil.

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This boiling heat can neither be produced nor continued without a brisk fire; and to talk of continuing the boiling over a very little fire is preposterous, for it cannot be done.

Breton mentions "litharge," but he does not add of silver, as Moxon does. It is not necessary to speak of its bad qualities in Printing Ink, as he describes them accurately, and condemns the use of it.

With regard to the red Ink and Ink of different colours, I shall only shortly observe here that carmine is too expensive to be used generally, and that it does not brighten vermilion in a degree that might be expected from its own brilliancy; — that no Printing Ink should ever require to be covered with water to prevent it skimming over; — and that mixing white lead or even any white colouring matter with the Ink invariably deadens the colour instead of making it clearer — White lead should never be used, on account of the metal reviving and turning black.

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Receipt for making Printing Ink, from LEWIS'S *Philosophical Commerce of Arts.* 1763.

"*Printing Ink.*

"Printing Ink differs from the common oil paint, described at the beginning of this section, only in the preparation of the oil, which must here have its consistence and tenacity greatly increased, and its greasiness diminished, by means of fire. The same way of preparation, either not carried to so great a length, or with a subsequent addition of fresh oil to dilute the mixture, affords, as already observed, one of the best drying oils for the black paint.

"The oils of linseed and nuts are made choice of for this use; the nut oil is supposed to be best, and is accordingly preferred for the black ink, though the darker colour which it acquires from the fire makes it less fit for the red. It is said that the other expressed oils cannot be sufficiently freed from their unctuous quality; whence the ink made with them dries exceedingly slowly, is apt to come off and smear the paper in the beating and pressing which it undergoes in the bookbinder's hands, or sinks into the substance of the paper, beyond the mark of the type, and stains it yellow.

"Ten or twelve gallons of the oil are set over the fire, in an iron-pot, capable of holding at least half as

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much more; for the oil swells up greatly, and its boiling over into the fire would be very dangerous. When it boils, it is kept stirring with an iron-ladle; and if it does not itself take flame, it is kindled with a piece of lighted paper or burning wood; for simple boiling, without the actual accension of the oil, does not communicate a sufficient degree of the drying quality required: it seems to be in the more inflammable parts, which are soonest condensed by the burning, that the injurious fatness or greasiness consists. The oil is suffered to burn for half an hour or more, and the flame being then extinguished by covering the vessel close, the boiling is afterwards continued, with a gentle heat, till the oil appears of a proper consistence, in which case it is called varnish. It is necessary to have two kinds of this varnish, more and less boiled, or a thicker and a thinner, which are occasionally mixed together as different purposes may require: that which is of a just consistence in warm weather proves too thick in cold; and that which answers well for large characters, proves in the same season rather too thin for smaller ones.

"The thickest varnish is of such consistence when cold, that it draws into threads between the fingers nearly like weak glue: this is the mark by which the workmen judge of the due boiling, a little of it being from time to time taken out for this trial, and cooled by dropping it on a tile or other cold body. It is very viscous and tenacious, like the soft resinous juices or thick turpentine. It is not at all dissolved, any more than the oil at first, by water or spirit of wine, but mingles readily enough with fresh oil, and unites with mu-

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cilages into a mass which dissolves in water into a milky liquor: by boiling with strong alcaline ley it forms a soapy compound; whence the types, after an impression, are cleaned from the ink, by washing, and rubbing them with a brush, in hot ley. The oil emits, during the whole time of the boiling, very offensive penetrating fumes: when grown cold, it has an acrid disagreeable taste, but little ill smell. The oil is said to lose, in being boiled into thick varnish, from a tenth to an eighth part of its weight, which proportions agree sufficiently with my trials: common linseed oil boiled down to a consistence which appeared somewhat too thick, lost about one sixth: being further boiled, till it became quite firm when cold, the loss was near one half. Different oils, and perhaps the same oil in different states, differ in this respect: fish oil, boiled to thickness, lost much more than that of linseed, the thick matter amounting only to about one fourth of the original weight of the oil.

"The workmen are accustomed to add, in the preparation of ten or twelve gallons of oil, as soon as the burning is over, a pound or two of dry crusts of bread, and a dozen or two of onions, by which they suppose the greasiness to be more effectually destroyed. It may however be questioned, whether additions of this kind are of much use; for I have prepared the varnish, seemingly of a very good quality, by fire alone.

"There is another sort of additions whose effect is more apparent. To give a greater body to the varnish, and increase its drying quality, a proportion of turpentine is thought necessary; and with some artists litharge

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has in this intention been a secret. It is observed, in the French *Encyclopédie*, by M. le Breton, the printer of that work, that when very old oil is used, neither turpentine nor litharge are needful; but that, when the oil is new, some turpentine must necessarily be employed, for without it, the smearing of paper, by the spreading or coming off of the ink, cannot be avoided; that it is much more eligible to use old oil than to have recourse to this correction of the new, both turpentine and litharge, particularly the last, making the mixture adhere so firmly to the types, that it is scarce to be got entirely off by the ley, whence the eye of the letter is soon clogged up.

" When turpentine is used, it is first boiled by itself, until, on dipping in a piece of paper, it is found to crumble and part from the paper when cold: the oil being then taken from the fire, the turpentine, while still fluid, is poured into it, after which the boiling is repeated, and continued till they are sufficiently incorporated.

" It is here somewhat more difficult to hit the due point of boiling, than when the oil is prepared without addition; the mixture being apt to grow too thick from continuing the heat too long, and full of little hard grains from not continuing it sufficiently; which grains are probably undissolved particles of the turpentine. The use of boiling the turpentine first by itself is to dissipate its moisture or essential oil: by the boiling it becomes a resinous matter, nearly the same with common resin, which possibly would answer the same end.

" For making the varnish into ink, lamp black is the common material, of which, according to M. le Breton,

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two ounces and a half are sufficient for sixteen ounces of the varnish. They are ground together on a stone with a muller, in the same manner as oil paints.

" The paper, for printing, is moistened with water, by which it is made more yielding and pliable, so as not only not to be torn by the types in the press, but likewise to be more closely and evenly applied to them, and consequently to take a neater and more perfect impression. The due moisture of the paper, and the care and attention of the pressmen in well working the ink on the types with the balls, are very material points; without which, how excellent soever the ink is, the impression will not be beautiful.

" The adhesion of printers ink to wetted paper, seems to shew that it is not truly of an oily nature. All expressed oils contain probably a gummy or mucilaginous matter; and perhaps the tenacity, consistence, drying quality, and the property of adhering to bodies moistened with water, which the oil acquires in the process above described, may be all owing to some of the purer part of the oil being destroyed, so as to leave the remainder more gummy. When the oil dries, it proves a tough flexible substance, which has little disposition to unite with fresh oil any more than with water, as if the gummy and oily matter were in such proportions, that one defends the other from the menstruum that would otherwise dissolve it: essential oils, on the contrary, being free from gum, harden into a merely resinous mass, brittle like other resins, and which dissolves, like the oil at first, in fresh oil or spirit of wine. The differences observed in different expressed oils, in regard to the

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drying quality, may depend on the different quantities of gummy matter, and the difference of old oil from new, on the gum being in the latter more intimately combined, so as not to separate in the burning and boiling. When these oils are first expressed out from the subjects, they abound with mucilage, great part of which is only superficially mixed, so as to give a turbidness and opacity to the fluid: in keeping, a part of this mucilage is thrown off, and the remainder may be presumed to become at the same time more intimately incorporated with the oil. The repugnance which we observe between oil and gum does not in the least invalidate these conjectures, any more than the repugnance between oil and water can be an argument against the existence of water in oils: indeed we have plain proofs of the coalition of oil with gum, in the analysis of the purest gums, gum arabic, senica, tragacanth, from which an actual oil is obtained by distillation. The distillation of expressed oils themselves seems to favour the opinion here proposed; from all of them there remains in the distilling vessel a large quantity, though from some more than from others, of a gross coaly matter: and there arises a fluid oil, which does not dry or grow thick in the air as the oils did at first; and which is therefore found to answer for certain purposes, as in the lapidaries business, for which the thickening of the oils in their natural state renders them unfit."

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Observations on Lewis's Receipt for making Printing Ink.

Lewis was not a Printer, but a scientific man, and has taken the process of making Printing Ink from Breton; of course the practical observations on Breton's receipt will apply to Lewis's.

The latter, however, made many experiments on boiling different kinds of oil, to ascertain their properties and fitness for making varnish, and came to the conclusion, as the result of those experiments, that "simple boiling, without the accension of the oil, does not communicate a sufficient degree of the drying quality required" for Printing Ink.

In speaking of the use of turpentine, he observes that by boiling it becomes a resinous matter, and thinks rosin would answer the same purpose.

His observations respecting the loss of weight in different oils by boiling to a state of varnish, is worthy of consideration, as fish oil is avowedly used in the metropolis for making fine Printing Ink by at least one house. It is generally acknowledged by all who use paints that even

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the best fish oil is much inferior to linseed oil in its drying quality, and it must from its nature abound with grease, which becomes a most injurious part of the composition, by separating from the Ink and sinking through and staining the paper; and I believe that no boiling, however long continued, would prevent this mischievous effect taking place: but even supposing this evil to be remedied, the expence of fish oil would be a bar to its general use; for the best sperm oil, which I should suppose would be used, is at least double the price of linseed oil, and according to Dr. Lewis's experiments, where linseed oil loses one sixth of its weight by boiling to a varnish, fish oil loses three fourths; thus, taking the price of linseed oil at two shillings and sixpence a gallon, and sperm oil at five shillings a gallon, which are about the prices, then a gallon of varnish made from linseed oil alone, which loses one sixth of its weight in boiling, would cost three shillings, and a gallon of varnish made from sperm oil in the same manner, which loses three fourths of its weight in boiling, would cost twenty shillings; and the incurring of this great additional expence would produce only an inferior article.

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PAPILLON'S *Method of preparing Printing Ink. Translated from Traité Historique et Pratique de la Gravure en Bois. Paris,* 1766.

Of the Manner of making Varnish and Ink for taking Impressions from Engravings on Wood, and of the Colours made use of in Printing Cameos.

Engraving in Wood being generally used along and in conjunction with ordinary printing types, it necessarily follows that the same Ink must be made use of in both cases. I proceed to lay down the manner of making this Ink, after first giving the process for making the varnish of which it is composed, and which was used by my late father.

Take two pints of good nut oil, the older the better, and put it into an iron pot, which should be of a size sufficient for the quantity to occupy one third of its depth. It is necessary to be prepared with an accurate cover to the pot, in order to extinguish the flame, should the oil catch fire, by holding it firmly on. The oil must be suffered to boil with a slow fire about two hours, when the grease may be taken out of it by throwing in an onion or a crust of bread. In order to discover whether it coagulates or thickens, dip a rod into it, and if the oil draws out in a thread on withdrawing it, it may be considered as done enough. Another iron pot,

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much bigger than the other, must be had in readiness, with its cover also well adjusted, in order to extinguish the fire in case of accident; in it must be put half a pound of turpentine,* which must also be prepared over a small fire at the same time with the nut oil.

In order to discover when the turpentine is done, a piece of paper must be put into it, which must after it is withdrawn be rubbed between the fingers, and if it falls into powder on rubbing it, it is enough; and we may be well assured that it is so if it cease to swell or rise up; and at the same time we must be on our guard not to overdo it, as then it will be burnt and robbed of its virtue. The nut oil must now be poured into the vessel containing the turpentine; they must be well stirred together with an iron spatula; and, after remaining on the fire a few moments the varnish will be completed. If it be thought desirable to withdraw a portion, in order to weaken the ink on any occasion, it must be put into a pot or other vessel, having care to increase the quantity both of the nut oil and turpentine, in proportion to the quantity of varnish intended to be withdrawn; and to the remainder in the iron pot, whilst the

* Unless the oil be too new, we may make a shift without the turpentine; I am aware besides, that some set the nut oil on fire with proper precaution, at different times, uncovering and covering it at various times to extinguish the fire, as they judge proper, holding the cover on firmly at the top, thus suffering the oil and its vapour to burn, and by and by, the fire slackening, it is once more uncovered and well stirred with an iron spatula, which completes the preparation.

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varnish is still hot, add half a pound or more, accordingly as the varnish has been made thicker or thinner, of German smoke black, as it is the best; the whole must now be mixed with an iron spatula, and, after suffering it to remain on a moderate fire a little while, it is done; and, if it be thought proper, it can be immediately tried on paper. This mode of preparing the Ink while the varnish is hot, is better than waiting till it is cold; as the incorporation can thus be more completely effected.

If, when we wish to use the Ink, it should be found too thick, a little of the varnish must be added, and the whole subjected to the stone and muller (brayer of the printers), which will render it more liquid; if it prove too grey coloured, black must be added, and the whole must be ground in like manner.

We should have a care to make our varnish and Ink in an open or uncovered place, and distant from other buildings, &c., so as to have no fear from fire.

Linseed oil, in defect of that of nuts which is the best, may be made use of in preparing the varnish: that of rapeseed, hemp, or others, are not so good, because they do not part with their greasy particles so readily as those first named; they also are apt to spoil the impression, and turn yellow by age: we should not be tempted by cheapness to use them in making Ink, as the saving is of no great moment.

We may, while making the varnish, withdraw a portion before it has attained its proper thickness, to be used in thinning the Ink in winter, by adding a little, and grinding the whole by the muller as it is necessary to use it; and we may in like manner in summer and in

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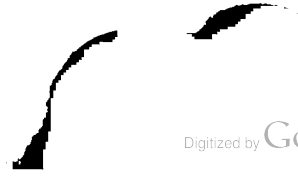
hot weather, add some of the thick varnish, to render it more consistent. Mons. le Breton, Printer to the King, has given a very curious article on the manner of making Ink for letterpress printing in the 5th volume of the Encyclopédie, page 633 et sequ., to which I refer the Reader.

It is also necessary to take care lest there be too much varnish in the Ink, as the proofs are liable in such case to become grey and spoiled, and turn yellow in process of time. I am able to speak decisively on all these points, having long employed Ink in printing paper hangings, &c. in large quantities, and having used perhaps as much on one sheet, as would serve a letterpress printer for a quire of paper.

There are people whose sole employ is to prepare Ink for the printers, as also the varnish without any colouring material, so that by means of it we can make our Ink of any colour we please: for red, vermilion may be used, grinding it well with the stone and muller before using it; commonly the weak varnish is the best to be used with vermilion, and if we wish to render our red very fine a little carmine must be added. We can produce green Ink by mixing verdigrise calcined, prepared and ground with the varnish; blue, by grinding prussian blue with it; yellow, by orpiment; violet, with fine calcined lake; wood colour, by umber, &c., taking care to use the weak varnish; and if we wish to lighten the tints using a proper portion of white lead.

The colours to be used in printing in cameo are purely arbitrary; but the most common practice is to make use of bistre, which is wood soot suffered to remain long in



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the chimney to season, and which has been baked or burnt, and, after throwing away the rough parts, well ground by the stone and muller. We may also make use of umber, indigo, and other colours used in painting, and even of Indian ink; also of all those of which I have spoken in the preceding paragraph. It must, however, be remarked, that all the colours possessed of a heavy body are the least adapted for printing in cameo.

Sometimes, however, impressions are taken off with the colours usually employed in painting in distemper. White lead properly mixed with these colours, whether in oil or in distemper, answers the purpose of producing lighter tints; whilst the lamp black renders those in distemper darker; and for those in oil a little Printing Ink, as commonly used, will produce the same effect.

Practical Observations on the Receipt for making Printing Ink, published by J. B. Papillon.

The process of making Printing Ink described by Papillon is so nearly similar to those of Moxon, Fertel, and Breton that few additional observations will be necessary.

He recommends, similarly to Breton, an onion or a crust of bread to take the grease out of the oil. — See the Observations, pp. 33 and 60.

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Papillon recommends German smoke black as the best; and what I have seen sold in England under that designation is certainly of a superior kind. But then the cost of this black is too much for the Ink that is generally used for book work, as the black alone would cost considerably more than the Ink would produce. The English lamp black makers manufacture it perhaps of as good a quality, so that there is no occasion to have recourse to the Germans for this article, even for the finest Ink. Our author is right in recommending to mix the black into the varnish while the latter is hot, as it is performed with much greater facility than when cold, and occupies less time.

Papillon also recommends the withdrawing of some of the varnish before it has attained its proper thickness, for the purpose of weakening the Ink when necessary. For my opinion of this bad practice see the observation at page 47.

For coloured Inks he too directs the use of white lead for lighter tints; carmine to brighten vermilion for red Ink; lamp black to darken tints; and weak varnish:—but it is of no utility to observe upon these directions, as I am convinced that neither Papillon nor any other practical writer on the subject of Printing Ink could ever produce an imitation of a water-

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coloured drawing, in all the variations of its washy tints, depths, distances, and foreground, with the Inks as they direct them to be made; and in support of this assertion I may be allowed to state, that I have examined productions by all the masters of this art in former days. I will therefore refer the reader to that part of this Treatise which speaks of coloured Inks, and for the effect of them to the Illustrations in my Work on Decorative Printing.

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BASKERVILLE'S *Method of making Printing Ink. From Hansard's "Typographia."*

"Various receipts have at different times been published on this subject, but none that I have hitherto seen seem calculated to produce the effect; it would be therefore, a folly to insert them here: the one I shall introduce, which has never before been published, has been given me as the mode practised by Mr. Baskerville, which a careful examination of his printing will fully prove to have stood the test of time.

"He took of the finest and oldest linseed oil* three

"* The linseed oil generally in the market, is totally unfit for the purpose of ink-making, being too frequently mixed with seeds of an inferior, drying, quality, or expressed from those which are damaged or unripe, and very often overheated in the steam-kettles in order to force out an additional quantity of oil; this excess of heat invariably causes a large portion of the mucilage to combine with the oil, and till that has subsided it is unfit for use. This mucilaginous combination is, in fact, more or less in all seed oils, which renders it necessary they should stand a very considerable time to subside, before being converted into varnish, which can only be regulated according to the quality of the oil, but in no case should it be used before twelve months old, and if kept longer will be considerably improved: good oil may, in some measure, be known by its appearance, the best being of a pale straw colour. This varnish, after being brought to

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gallons, this was put into a vessel capable of holding four times the quantity, and boiled with a long-continued fire till it acquired a certain thickness or tenacity, according to the quality of the work it was intended to print, and which was judged of by putting small quantities upon a stone to cool, and then taking it up between the finger and thumb; on opening which, if it drew into a thread an inch long or more, it was considered sufficiently boiled. This mode of boiling can only be acquired by long practice, and requires particular skill and care in the person who superintends the operation, as, for want of this, the most serious consequences may occur, and have very frequently occurred.* The oil thus prepared was suffered to cool, and had then a small quantity of black or amber rosin dissolved in it,

its proper consistence, requires to stand for at least two months, that the decomposed mucilage and other matter may subside to the bottom, it will then be fit for use. Some makers add to their varnishes boiled turpentine; others rosin, and, not unfrequently, soap; these are useful in some instances, particularly in rendering the type easier to be cleaned, as, without something of this kind, the ink will be difficult to wash off, but only in this particular can they be of service."

" * If flame once communicates to the oil in this state, nothing can extinguish it but instantly closing the pot or vessel, so that no air can draw in to feed the flame. One of the most tremendous fires that happened in this metropolis a few years since was thus occasioned; no making of varnish should ever be attempted within the walls of a printing office."

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after which it was allowed some months to subside; it was then mixed with fine black, to a proper thickness, and ground for use. [This black was collected from glass-pinchers' and solderers' lamps.]

"This method, with very little modification, I have every reason to suppose, was pursued by Mr. Bulmer in the making of his ink for the Shakspeare and some other fine works printed in the early part of his practice: and I have it from the best authority, that when the boiling of the oil is properly managed and the black well mixed and ground, no finer or better working ink can be made."—*Hansard's Typographia, p. 722.*

Observations on Baskerville's Method of preparing Printing Ink, published in Hansard's Typographia.

I am enabled to give this Receipt of Baskerville's, by the kind permission of Mr. T. C. Hansard, in whose interesting work on printing, entitled "Typographia," it first appeared.

Mr. Baskerville was one of the first printers in England who endeavoured to improve the art, and the productions of his press are in estimation; but I am perfectly satisfied in my own mind that he never used any Printing Ink made according to the preceding formula which

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is given under his name, for it could not be worked with, any more than Moxon's, Fertel's, Breton's, or Papillon's, for the reasons I have stated when treating on their methods; in fact, it appears to me to be the copy of a memorandum that he had made of the old method of making Ink, similar to some of those which I have given.

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On Printing Ink, from the Encyclopædia Britannica. Article INK.

"*Printing* INK, is totally different from Indian Ink, or that made use of in writing. It is an oily composition, of the consistence of an ointment: the method of preparing it was long kept a secret by those whose employment it was to make it, and who were interested in concealing it; and even yet is but imperfectly known. The properties of good Printing Ink are, to work clean and easily, without daubing the types, or tearing the paper; to have a fine black colour; to wash easily off the types; to dry soon; and to preserve its colour, without turning brown. This last, which is a most necessary property, is effectually obtained by setting fire to the oil with which the Printing Ink is made for a few moments, and then extinguishing it by covering the vessel.* It is made to wash easily off the types by using soap as an ingredient; and its working clean depends on its having a proper degree of strength, which is given by a certain addition of rosin. A good deal, however depends on the proportion of the ingredients to each other; for if too much soap is added, the Ink will

"* This is mentioned by Dr. Lewis in his Philosophical Commerce of Arts; but he seems not to have been acquainted with the method of giving it the other necessary properties."

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work very foul, and daub the types to a great degree. The same thing will happen from using too much black, at the same time that both the soap and black hinder the Ink from drying; while too much oil and rosin tear the paper, and hinder it from washing off.—The following receipt has been found to make Printing Ink of a tolerable good quality.

" Take a *Scots Pint of Linseed Oil*, and set it over a pretty brisk fire in an iron or copper vessel capable of holding three or four times as much. When it boils strongly, and emits a thick smoke, kindle it with a piece of paper, and immediately take the vessel off the fire. Let the oil burn for about a minute; then extinguish it by covering the vessel; after it has grown pretty cool, add *two pounds of Black Rosin*, and *One Pound of Hard Soap* cut into thin slices. If the oil is very hot when the soap is added, almost the whole mixture will run over the vessel. The mixture is then to be set again over the fire; and when the ingredients are thoroughly melted, *a pound of Lamp Black*, previously put through a lawn sieve, is to be stirred into it. The whole ought then to be ground on a marble stone, or in a levigating mill.

" Though the above receipt is greatly superior to any that hath been hitherto published, all of which are capitally deficient in not mentioning the necessary ingredients of Rosin and Soap; yet it must be acknowledged, that Ink made in this manner is inferior in point of colour, and is likewise more apt to daub the types and make an indistinct impression, than such as is prepared by some of those who make the manufacture of this

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commodity their employment; so that either a variation in the proportion of the ingredients, a nicety in the mixture, or some additional ingredient, seems necessary to bring it to the requisite perfection."

Observations on the Receipt for making Printing Ink in the Encyclopædia Britannica.

The editor of the Encyclopædia Britannica stands alone in not having copied the old and useless receipts. The information he obtained was evidently from one who knew generally the process and the ingredients necessary for making Printing Ink, but whether he was ignorant of the correct mode of preparing the different articles, and their due proportions in their admixture, or gave the information to mislead, he has given a receipt from which a Printing Ink might be made that could be worked with, but which, I am bound to add, could not be used for respectable work.

If the boiling of the oil be hurried, so as to make it boil strongly as soon as possible before trying to set it on fire, as appears to be implied in the directions here given, I am afraid that it would become so violent as to take fire spontaneously, and become completely unmanage-

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able, be attended with danger, and the oil would be inevitably wasted.

The direction is to set fire to the oil, and let it burn for about a minute; this time of burning would produce no sensible difference in the quality of the oil, which with this treatment would separate from the colouring matter and sink through the paper; the proper point to which the oil ought to be boiled and burnt can only be ascertained by repeatedly extinguishing the flame and trying its consistency, till it be sufficiently done, which may take from half an hour to an hour and a half.

There is too much soap in the composition, which would produce the evil complained of—daubing the types and making an indistinct impression. It should be added gradually, which will prevent the oil boiling over.

The proportion of lamp black is too small, which would operate as one cause of the Ink being inferior in point of colour. The quality of the lamp black is not mentioned.

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Of making Printing Ink, from NICHOLSON'S *Dictionary of Chemistry.* 1795.

" The general composition of *Printers' Ink* is well known, but the particulars of the process by which Ink of the best quality is made are kept secret by the few manufacturers of this article. It is probable, that the demand is not sufficient to afford inducements for men of research to make many experiments on this object, and it is not unlikely that much may depend on minute circumstances in the management.

" Good Printers' Ink is a black paint, smooth and uniform in its composition, of a firm black colour, and possesses a remarkable aptitude to adhere to paper thoroughly impregnated with moisture. It is remarkable, that this composition adheres uniformly to the wetted sheep-skin cover of the printers' balls, which a common oil paint would not do; that it quits the wet ball to adhere to the face of the dry metallic type, and this so perfectly as to leave a new skin bare where the type touches it; and that much the greater part of the Ink afterwards leaves the type to adhere to the moistened paper, but will not if the paper be dry. If the Ink do not possess these requisites, it will not work well, but will clog the face of the letter, and give an imperfect impression.

" The * consistence and tenacity of the oil in this

" * Lewis's Philosophical Commerce of Arts."

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composition are greatly increased, and its greasiness diminished, by means of fire. Linseed oil or nut oil is made choice of for this use. The nut oil is supposed to be the best, and is accordingly preferred for the black ink, though the darker colour it acquires from the fire renders it less fit for the red. It is said, that the other expressed oils cannot be sufficiently freed from their unctuous quality; whence the Ink made with them dries exceeding slowly, is apt to come off and smear the paper in the beating and pressing it undergoes in the hands of the bookbinder, or sinks into the substance of the paper beyond the mark of the types, and stains it yellow.

"*Ten* or *twelve Gallons of the Oil* are set over the fire in an iron pot, capable of holding at least half as much more; for the oil swells up greatly, and its boiling over into the fire would be very dangerous. When it boils it is kept stirring with an iron ladle; and if it do not itself take fire, it is kindled with a piece of flaming paper or wood; for simple boiling, without the actual accension of the oil, does not communicate a sufficient degree of the drying quality required. The oil is suffered to burn for half an hour or more, and the flame being then extinguished by covering the vessel close, the boiling is afterwards continued with a gentle heat, till the oil appears of a proper consistence: in which state it is called varnish. It is necessary to have two kinds of this varnish, a thicker, and a thinner, from the greater or lesser boiling, to be occasionally mixed together, as different purposes may require; that which answers well in hot weather being too thick in cold, and large characters not requiring so stiff an ink as small ones.

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"The thickest Varnish when cold may be drawn into threads like weak glue; by which criterion the workmen judge of the due boiling, small quantities being from time to time taken out and dropped upon a tile for this purpose. It is very viscid and tenacious, like the soft resinous juices or thick turpentine. Neither water nor ardent spirit dissolves it; but it readily enough mingles with fresh oil, and unites with mucilages into a mass diffusible in water in an emulsive form. Boiling with caustic alkali produces a soapy compound. It is by washing with hot soap-lees and a brush that the printers clean their types. The oil loses from one tenth to one eighth of its weight by the boiling into the thick varnish. This loss seems to differ in different samples of the same kind of oil. Dr. Lewis found that fish oil lost three fourths of its weight by this treatment, before it acquired the thickness produced in linseed oil.

"The workmen are accustomed to add in the preparation of ten or twelve gallons of oil, as soon as the burning is over, *a pound or two of dry crusts of Bread*, and *a dozen or two of Onions*, by which they suppose the greasiness to be more effectually destroyed. Dr. Lewis, with much appearance of justice, doubts the advantage of such additions, and that more especially, as he prepared the varnish seemingly of a good quality by the fire alone. There are other additions of more evident effect, namely, *Turpentine* or *Litharge*, both which are occasionally used. The turpentine is boiled first by itself to a state nearly of resin, and the oil being taken from the fire, the hot fluid turpentine is poured in, and the boiling then continued to the proper point.

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This is somewhat difficult to attain, because the mixture is more disposed to grow too thick if over-boiled; and is full of little hard grains, probably of resin, if not sufficiently boiled. It is affirmed that varnish containing either turpentine or litharge, particularly the latter, is more adhesive than other varnish, and presents a great difficulty in cleaning the types, which soon becomes clogged. Very old oil requires neither of these additions. New oil can hardly be brought into a proper state for drying, so as not to set off, without the use of turpentine.

"*Lamp Black* is the common material to give the black colour, of which two ounces and a half are sufficient for sixteen ounces of the varnish. Vermilion is a good red. They are ground together on a stone with a muller, in the same manner as oil paints."

Practical Observations on the Receipt for making Printing Ink given by Nicholson in his Dictionary of Chemistry.

Mr. Nicholson was also a scientific man, and not a printer; and he is wrong in some of his preliminary remarks on the properties of Printing Ink:—he says that it will adhere to the face of the dry metallic type so perfectly as to leave a new skin bare where the type touches it (this refers to pelt balls); now this is not owing so much to its adhering to the type as to the con-

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dition of the ball; for if the pelt has not been well trodden or well curried, some portions of the face of the ball will be surcharged with moisture, and however completely the face of the balls may be covered with Ink when first distributed, as soon as a form is beat with them these portions will be completely deprived of the Ink and left bare. This effect will also be produced if the balls be placed in the rack after being distributed, for the moisture prevents the Ink from continuing to adhere to the pelts;—the fact is well known to every pressman who has been in the practice of working with pelt balls, and is technically called *Spewing off the Ink;* the remedy is also as well known.

Mr. Nicholson also says, that much the greater part of the Ink leaves the type to adhere to the moistened paper, but will not if the paper be dry. This is not the fact; for though the face of the type would not be left so clear of Ink with dry paper as with moist paper with the same pressure, yet by increasing the power at the press the face of the type may be left as clear of Ink with dry paper as with wet paper. This is not a theoretical opinion of mine, but an opinion derived from practice; for I have printed thousands of impressions upon dry paper with Inks of my own preparing, where

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large surfaces were to be covered, and after three or four hundred impressions were worked the surface was as clear of Ink nearly as it was before an impression was printed.

I would always cautiously avoid proceeding with boiling the oil till it took fire of itself, on account of the great danger of its becoming unmanageable, and at the least losing the oil and the time in preparing it, besides the risk of more serious accidents. It is attended with very little trouble to try it occasionally.

I have expressed my opinion on a thicker and thinner varnish from a greater or less boiling in my observations on Fertel's method of making varnish. I have expressed my opinion too on turpentine; and also on bread and onions.

It is my opinion that whenever there are little hard grains of rosin in the Ink, it arises from a deficiency of heat in the oil after the turpentine or rosin is put in; for when it is considered that oil is at the temperature of about 600° of Fahrenheit's thermometer when it boils, and that rosin is completely melted at 306°, it is evident that if the oil be again raised to the boiling point after the rosin is inserted, that the latter must be melted, and that there can be no small grains of it in the Ink; of course when this happens it must be from mismanagement.

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Mr. Nicholson does not mention the quality of the lamp black:—he gives too small a proportion.

He specifies no particular quantity of turpentine or litharge, nor does he mention rosin.

Upon the whole, this is a vague description of the manner of preparing Printing Ink, and even if an Ink could be made from it, it could not be worked with from the want of soap in the composition.

It is evident, on perusal, that Mr. Nicholson has taken the substance of this receipt from Lewis's Philosophical Commerce of Arts; who in his turn took his practical information from Breton. The Observations made on those two Authors with respect to the preparation will, of course, apply to Nicholson's Method.

In Aikin's Dictionary of Chemistry the process of preparing Printing Ink is avowedly taken from Lewis, on which account it is not necessary to make any additional observation.

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The Method of preparing Printing Ink, from REES'S *Cyclopædia.*

"*For Black Ink.*—A hundred pounds of nut or linseed oil, being reduced, by boiling, to the consistence of a syrup, are cleansed and purified by throwing into them two pounds of coarse bread, and about a dozen onions. Nut oil is supposed to be the best, and is accordingly preferred for the black ink, though the darker colour which it acquires from the fire makes it less fit for the red. This oil is boiled in an iron pot, capable of holding at least half as much more, because it swells very much; when it boils it is kept stirring with an iron ladle; and if it does not itself take flame, it is kindled with a piece of lighted paper, or burning wood, in order to increase its consistence and tenacity, and to diminish its greasiness. The oil is suffered to burn for half an hour or more; and the flame being then extinguished by covering the vessel close, the boiling is afterwards continued, with a gentle heat, till the oil appears of a proper consistence, in which state it is called varnish; of which there should be two kinds, one more and another less boiled; or a thicker and thinner, to be used for different purposes, and in different weathers. The oil is said to lose in being boiled into thick varnish from a tenth to an eighth part of its weight; but different oils, and perhaps the same oil in different states, differ in this

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respect. The design of adding the bread and onions is more effectually to destroy the greasiness; but Dr. Lewis doubts, whether additions of this kind are of much use. They then boil thirty or thirty-five pounds of turpentine apart, till such time as they find, upon its cooling on paper, that it breaks clean, like glass, without pulverizing, for if it pulverise easily, it is a sign that it is burnt. The oil and turpentine being thus prepared, the first is gently poured, half cold, into the latter; and the two stirred together with a stick till they be well mixed: after which the boiling is repeated and the composition is set by, to be used occasionally. The turpentine is used in order to give a greater body to the varnish, and to increase its drying quality; and with some artists, litharge has in this intention been a secret. M. de Breton, in the Encyclopédie, observes, that when very old oil is used, neither turpentine nor litharge are needful; but that when the oil is new, some turpentine ought to be employed, because, without it, the smearing of the paper, by the spreading or coming off of the ink, cannot be avoided; and he adds, that it is much more eligible to use old oil than to have recourse to this correction of the new; both turpentine and litharge, particularly the last, making the mixture adhere so firmly to the types, that it is scarcely to be got entirely off by the ley, whence the eye of the letter is soon clogged up.

"Now to proceed to make ink, they take a quantity of this mixture, and add to it a certain quantity of lamp-black, working it up with a kind of wooden mallet, or brayer, till the whole be incorporated, and reduced into a kind of pulp, which is the ink for use.

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" Where, note, that its thickness or strength is always to be proportioned to that of the paper, and the warmth of the weather; strong paper and hot weather requiring strong ink: and that the strength or weakness of the ink depends on the greater or the less degree of coction of the varnish. According to M. de Breton, two ounces and a half of the lamp-black are sufficient for sixteen ounces of the varnish. — *Lewis's Commerce of Arts, p.* 371.

" *For Red Ink*, they use the same materials as for black, excepting only, that instead of lamp-black, they add a proper quantity of vermilion. Some hold, that, by mixing and incorporating the bigness of a nut of fish-glue, or brandy, or the white of an egg, with the ink, the vermilion acquires a greater lustre."

As the directions for making Printing Ink in Rees's Cyclopædia are taken from Breton and from Lewis, the observations which I thought it necessary to make on those receipts will equally apply to this, and thus render it unnecessary to repeat them.

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The Manner of making Varnish for the Composition of Printing Ink. Translated from The Manual of Printing. Paris, 1817.

Printing Ink is composed of two things; namely, varnish and lamp black. For making this varnish it is necessary to have an iron or a brass pot, of which some are manufactured for the express purpose, large at the bottom and narrow at the top, with a handle at each side to pass a stick through, in order to carry it from place to place. As the oil is liable to catch fire in boiling, it is necessary that the cover should fit exactly, in order to extinguish it.

We must not much more than half fill our pot, as the oil increases in measure as it warms, and there is danger of its overflowing into the fire; this requires attention, and we shall speak of it hereafter.

There are but two sorts of oil of which it is proper to make varnish; namely, linseed oil and nut oil: every other kind of oil is worthless, being too greasy; and Ink made from them always macules the impression, and turns yellow after being some time printed. Notwithstanding these objections, rape and hemp oils were formerly used, but only in the printing of Almanacs, and other such works of low price, where a fine impression was not of importance.

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Having thus put into the pot the quantity of oil which we have said, place it on a clear fire, such as is desirable under a pot of soup, until the oil is well heated, and in an inflammable state; that is to say, two hours, or thereabouts.

At this time throw in a crust of bread, in order to absorb the greasy particles of the oil, which it effects, and is itself converted into charcoal; as soon as this crust is withdrawn, replace the oil on a small fire for the space of about three hours; after which time, to know if the oil be sufficiently done, take a little out with an iron spoon, and let a few drops fall on a slate or tile, and as soon as the drops are cool touch them with the finger, and if the oil draws out in threads like weak glue it is evident that it is sufficiently done, and that it is no longer oil but varnish; if it does not yield this sign it must be replaced on the fire until it affords the desired proof.

The varnish being thus made, leave it to cool in the same pot until the next day, then pour it into the vessel in which you intend to make the Ink.

As it may happen that the varnish may be too strong to make Ink in winter, the precaution ought to be taken of drawing a proportionate quantity off an hour after the crust of bread has been withdrawn from the pot, in order that you may possess the means of weakening the varnish, if it should prove too strong; and this will also serve for printing copper plates.

It must, however, be particularly noticed that the oil which is drawn off be sufficiently done, or it will make the impressions that are printed with it yellow and sticky,

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and very much discharge or set off: this we perceive when the balls do not cling together in distributing, and it is a fault against which we ought particularly to guard.

As during this process the oil is extremely liable to take fire, principally when it is about to be converted into varnish, we must use the following precautions:—

As soon as we have placed our pot of oil on the fire, we must take some cloth, generally coarse linen, and after having immersed it in water, and wrung it well, fold it in four or five thicknesses, and leave it to drain, in order that if you are obliged to use it you may not mix any water with the oil, for this would increase instead of extinguishing the fire.

A strong stick must be provided, ready for carrying the pot in case of the oil catching fire, in order that necessary things may not be wanting when the moment of danger arrives, as there is great risk of the fire augmenting too strongly to be extinguished.

When it is perceived that the oil is becoming so hot that there is danger of its overflowing the pot, or when the oil has caught fire, the cover must be instantly placed on the pot, the stick passed through the handles, and carried into the open air. If it be in a garden that the oil is boiled, lift it a little distance from the fire, observing to carry it in such a manner as to prevent any flame that may arise through a vent of the cover from injuring the persons who convey it, and then let it be placed very gently on the ground, for fear of oversetting it.

When the pot is thus placed on the ground in a very even place, the cover ought to be lifted off with a stick, for fear of the person being burnt by the flame, and the

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oil suffered to burn briskly; if it should burn so briskly as to threaten to overflow the pot the cover must be put on again immediately; if that is not sufficient to extinguish the fire, the wet cloth must be thrown on in such a way as to exclude the air; and thus it must be left till a black and thick smoke is seen rising all round the pot, which may take place in about half a quarter of an hour; and by using these precautions the risk of being burnt is not incurred, nor that of overturning the pot, which has often happened through want of due care.

There are some printers who contend that it is necessary to put turpentine into the oil, saying that it renders the Ink more strong; that it hinders the impression from discharging; and that it dries sooner: all this is incontestable; but they do not consider the accidents which it may cause, and which we shall proceed to show.

1st. When the turpentine is not done precisely as it ought to be, mixing it with the oil makes the varnish so strong and thick that it tears the paper upon the letters of the form, and fills them up in a little time.

2dly. When the turpentine has been properly prepared, it is sufficient to say that it is like a strong liquid paste, full of little grains, like sand, which never can be separated from the varnish, and rest at the bottom of the pot; so that when we come to use it, we ought not to wonder that the little grains fill up the letters of the form.

The turpentine is done separately in a pot, and ought absolutely to be boiled in the open air, because it catches fire so easily, and it is so difficult to extinguish. When the turpentine has been upon the fire about two hours

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take a small piece of paper and dip it in the pot; if it breaks clean when it is dry and will not rub off the paper like dust, it is a proof that it is sufficiently done. Then remove the pot of varnish from the fire, put in the turpentine, and mix them together with an iron ladle; after which replace the varnish on the fire for a quarter of an hour, stirring it round at intervals, in order that the varnish may be well mixed with the turpentine.

Those who do not use the turpentine, for the reasons which we have assigned, make their provision of oil from one year's end to another; for the older it is the sooner it is done, and by this precaution the varnish is not subject to macule the impression.

The manner of making Smoke Black, and of mixing it with the Varnish for making Printing Ink.

Smoke black is the fume of pitch resin burnt and collected in a little chamber, well enclosed, and hung entirely round with sheep skins, and then shaken off. As it is dangerous to manufacture this black within a house, it is better to construct a little tent, with a roof of tiles, a short distance from any dwellings.

Those whose occupation is to make this black call this tent a *Sac-à-noir*. It is constructed of four little rafters, of three or four inches square, and of seven or eight feet high, supported by two transverse pieces of wood on each side, one at the bottom and one at the top, the same as in a bedstead, with a little door, but so low as not to admit of entrance but by stooping.

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Sometimes the *sac-à-noir* is constructed large, according to the pleasure of the proprietor: the roof of the *sac* is formed of planks, well joined together; some persons make the floor in the same manner, but as there is much danger that an accidental spark might communicate fire it is better to have it of square tiles of earthen ware well joined. Cloth is then stretched from each side of these rafters as strongly as possible, and fastened with small nails two inches apart. It is necessary to fill up the vents on all sides, by pasting strips of strong paper upon the cloth on the outside, and the same upon the joints of the floor, and round the edge of the bottom, in order to prevent the fumes escaping, as these fumes make the black.

The *sac-à-noir* being thus erected and arranged, an iron pot must be taken, which, for fear of setting it on fire, must be proportioned to its size: this we fill with pitch resin up to nearly an inch of the brim, broken beforehand into pieces of about an inch square.

The pitch resin being thus in the pot, place it in the middle of the *sac-à-noir*, set fire to it with paper, and when it is well lighted shut the door, which ought to be well joined and carefully stopped, either with paper or cloth.

When the pitch resin is entirely consumed, and all the smoke attached to the interior of the *sac-à-noir*, which can easily be known by the outside being entirely cold, it is necessary to strike it on the top and all round the exterior, to make the black fall within.

When all the black is fallen, which takes place in about half a quarter of an hour, the door must be

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opened, and the black swept into a heap with a little broom, and put into a suitable vessel; and the same routine repeated.

The operation of filling the pot and burning the resin can, however, be repeated as often as the manufacturer chooses without its being necessary to shake down and collect the black each time. The precaution of covering the pot must always be taken before the black is shaken down, to prevent its falling in.

Sometimes it happens that in gathering up the black from the floor we collect with it particles of dust, gravel, or some other thing detrimental to it. In this case it must be put into a vessel with water, when the dirt will fall to the bottom, and the black remain at the top.

Thus we see the manner in which smoke black is made for the use of printing.

Of mixing the Black with the Varnish to make Ink.

To mix the black with the varnish it is necessary to pour the varnish into a little vessel in which is the smoke black, for every other kind of black is good for nothing for printing; the lighter it is the better. The greater quantity there is put in, the thicker is the Ink: this is the reason why more must not be put in than is necessary. It must then be stirred very hard with a stick made expressly for the purpose, in order that the black may be well mixed with the varnish, and the whole reduced to the consistence of a paste, when it must be taken from the fire. Let it be remembered, that each time a portion is taken from it and put on the ink

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table for use, that it must be well rubbed out with the brayer.

It must be observed that the inking table ought to be well cleaned, because there generally collects upon it particles of hair, wool, or other such matters.

When it is thought desirable to mix the Ink upon the ink table of the press, five ounces of smoke black are generally put to two pounds of varnish, avoirdupois weight; but as this cannot be reduced to an exact rule, as the black varies in heaviness, and the varnish in consistence, two measures ought to be used, and kept expressly for the purpose, one for the varnish, the other for the black, having first arrived at a certainty respecting each quantity; and by these means it will be easy to continue mixing the Ink of an uniform blackness and thickness.

Thus having put on the ink table the respective quantities of black and varnish which are necessary, they must be mixed together in the manner we have before described.

Red Ink.

In making red Ink, the same varnish is used as for black, except that it must not be so strong, and instead of the black some cinnabar or vermilion must be put in, which ought to be well mixed on the marble, (this is to be understood when it is mixed on one,) and afterwards on the ink table, in the same manner as we have described in speaking of the black. To this must be added a piece of isinglass, the size of a nut, which has been steeped four and twenty hours in brandy, which

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renders the Ink very lustrous. This Ink ought to be stirred every morning and afternoon, in order that the red and the isinglass my be well mixed with the varnish. A crust generally forms on the top of the Ink when it has not been used for some time, to prevent which some water must be put on the ink table, and kept there until the Ink is required for use, when it must be thrown away, and the Ink stirred as usual. Thus may be seen the best method of making red Ink.

Of the black which is used for copper plates, contrary to that designed for letter-press printing, the heaviest is the best; and this is the method of making it:—some dregs, grounds, or lees of wine must be had, which being well dried, must be burnt in the middle of the fire, and when reduced to charcoal extinguished in water. This is stirred into the varnish in the same manner as the vermilion, observing only, that it is much more liquid than that used for letter-press printing.

My principal reasons for translating and inserting this receipt are, that Mr. T. C. Hansard has given it in the original language in his "Typographia," and spoken of it in terms of high praise; and that the English reader might have an opportunity of judging of its merits: but as it does not to my apprehension bring forward any new facts beyond those given by Moxon, Fertel, Breton, and Papillon, and as it appears to have been derived from the two last, the observations I have made upon their

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methods of preparing Printing Ink will apply equally to this receipt.

I have collected together and inserted every receipt for Printing Ink which has been given to the world, and that could be said to possess the slightest claim to notice on account of the respectability of the authors or of the works in which they appeared. Thus in the preceding pages will be found the result of all the practice and all the experiment which has borne upon the subject, and I have given them, not for the sake of their own intrinsic merit, or with any probability of real usefulness, but because I wished to lay before my readers at one view the extent of what had been done before I added my labours to those of my predecessors. Others there certainly are, but as they would only serve to swell this volume without adding any information, I leave them, and proceed to unfold the result of my own practice, trusting that the years which have been devoted to the subject may have enabled me to leave it in a far different state from what I found it when I commenced my research.

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CHAPTER III.

ON THE MATERIALS AND IMPLEMENTS FOR MAKING PRINTING INK, WITH OBSERVATIONS.

PRINTING INK is a composition, formed of two articles; namely, Varnish and Colouring Matter.

The varnish may be either in its natural state, as the vegetable balsams; or a compound, as generally used, formed of oil, rosin, and soap.

The colouring matter varies in black Ink, according to the quality of the Ink; and in coloured Inks, according to the tinct required.

In the following pages I shall enumerate the ingredients, with observations on their properties; the method of preparing the varnish; the preparation of black Ink of different qualities, and a variety of coloured Inks; with an enumeration and description of the necessary implements.

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Linseed Oil.

Linseed oil is so generally used as the basis of the varnish, and answers so well for general purposes, when properly prepared, that it does not appear necessary to speculate on the properties of other oils for this purpose. It is generally allowed that the older it is the better, for making varnish.

It will be observed, that in the receipts for making Printing Ink which have been published, and which I have given in the preceding part of this Treatise, the French prefer nut oil to linseed oil, but they do not specify in what particulars its superiority consists; and as nut oil is not in this country an article of commerce in a large way, it might not always be procurable with facility. They also mention rape oil, hemp oil, and other vegetable oils as worthless for making varnish for Printing Ink.

Moxon, in the Dutch method of making Printing Ink, mentions linseed oil only, which he says should be old, the older the better; Fertel says "there are but two sorts of oil which are proper for making varnish; namely, linseed oil and nut oil," and he does not express any opinion of a preference to either; Breton,

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in speaking of the qualities of nut oil and linseed oil, is not consistent—in one place he says, "Linseed and nut oils are the only proper ones for making good varnish for printing; that of nuts merits the preference in every respect." In another place "The weak varnish can be made at the same fire as the strong, but in a separate vessel: we can thus employ, and it is my advice, for this varnish linseed oil; because that in preparing *it keeps a clearer colour, and clogs less than nut oil.*" Subsequent writers have not noticed this discrepancy, but have continually given the preference to nut oil, on his authority in his first assertion, without further examination. In my opinion his second passage is decisively in favour of linseed oil—for that varnish must be the best, ceteris paribus, that is of the clearest colour and clogs the letter the least in working, two qualities essential to good Printing Ink.

Rosin.

The rosin that is used in making varnish for Printing Ink is either black rosin or amber rosin, but amber rosin is the most generally employed, as being more common in the market than the other.

It is an important article in the composition

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of good Ink, as by melting it in the oil, when that ingredient is sufficiently boiled and burnt, the two articles combine and form a compound approximating to a natural balsam, which, perhaps, is the best varnish for Printing Ink that can be used. It prevents the oil separating from the colouring matter and staining the paper, and gives a binding quality to the Ink which prevents its smearing; and this tenacious quality may be qualified to any degree, as will be observed under the next article.

I noticed in my Observations on Fertel's method of preparing Printing Ink, where he says the turpentine after it is done is full of little grains of sand, which never mix with the varnish, but rest at the bottom of the pot, and fill up the letters of the form, that I thought they were deceived by appearances, and that the oil did not boil, otherwise it would have been completely melted by the heat of the oil; I am confirmed in this opinion by the following passage:—"Resin fuses at 276° Fahrenheit; is completely liquid at 306°, and at about 316° bubbles of gaseous matter escape, giving rise to the appearance of ebullition. By distillation it yields empyreumatic oils: in the first part of the process a limpid oil passes over, which rises in vapour at 300° F., and boils at 360°; but

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subsequently the product becomes less and less limpid, till towards the close it is very thick. This matter becomes limpid when heat is employed, and boils at about 500° F."—*Turner's Elements of Chemistry, p. 723. 3d edit.* 1831.

Linseed oil requires a heat of 600° F. to raise it to the boiling point, so that it appears evident that rosin, which becomes completely liquid at 306° must entirely dissolve in boiling linseed oil,—and turpentine prepared in the manner described becomes rosin,—and that when these grains are in the varnish the oil could not have been so hot as even 306° when the rosin was mixed with it. My reason for dwelling on this point is to observe, that the varnish should not be kept on the fire at this great heat longer than is necessary to unite the rosin with the oil perfectly, otherwise it will become too strong, owing to the evaporation which would take place from the rosin.

Soap.

This is a most important article in the preparation of Printing Ink, and what is surprising, it is not noticed in any of the old receipts that have been published; the Encyclopædia Britannica is the only work I have seen that

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mentions it; and the use of it in England is kept a profound secret.

It may be fairly presumed, that neither Moxon, when he published the detailed account of the Dutch method of making Printing Ink, nor any of the French writers, knew the use and value of this material; and this presumption explains why the old printers were obliged to knock up their balls so often; why they were obliged to wash their forms so frequently and with hot lie; and why they directed water to be put over their Ink, to prevent it skimming over:—for the want of soap in the preparation would cause all these imperfections—without it the Ink would accumulate on the face of the types, so as to completely clog it up after a comparatively few impressions were printed; it would dry so hard on the types as to require to be frequently washed with *hot* lie to clean it, which would be attended with great trouble and delay; and would cause the Ink to skin over, which would occasion waste, and also cause picks in the form in working, that would spoil the appearance of the work, and give great trouble to the workmen; and would also harden the balls in such a manner, as to make it necessary to take the pelts off and steep them every dinner time and

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every night when the pressmen gave over work, which was the custom when Ink was prepared without it. In fact, without soap Printing Ink at the present day could not be used. I have only reasoned on printing by means of presses; with machines, which require a weaker Ink than presses, it would be totally impossible to use it.

Its properties are—to cause the Ink to adhere uniformly to the face of the type, and to give it a complete coating with the smallest quantity; to cause the Ink to leave the face of the type clean, and attach itself to the damp paper by the action of pressure, and during the process of printing to continue to do this through innumerable impressions; also to cause the Ink to wash easily off the type; and to prevent the Ink skinning over, however long it may be kept.

For black and dark coloured Inks the best yellow or turpentine soap may be used; but it should be well dried. For light and delicate coloured Inks curd soap is preferable, which is white, and does not affect their tincts.

If too great a proportion be used, it has a tendency to render the colour unequal where a large surface is printed; to spread over the edges of the types, so as to give them a rough

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appearance; and to prevent the Ink drying quickly, and to set off when pressed. The proper proportion is when the Ink will work clean, without any accumulation or clogging on the surface of the types or engraving, and then the impression will be clear; if the proportion be greater, the effect just described will be produced. It thus corrects, to any extent required, the binding quality of the rosin in the varnish.

It appears to me that the use of this article in the preparation of Printing Ink, which is now indispensable, is a modern addition, and a great improvement; for I am persuaded both Moxon and Papillon would not have omitted to mention it if they had been acquainted with its valuable properties, from the frankness and openness with which they both communicated their information, the one, in all that was connected with printing in his day; and the other, in what related to engraving on wood, and the process of printing the subjects when engraved.

Lamp Black.

This article varies very much in quality, and equally so in the proportion that is required for a given quantity of Ink; so that any directions

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must be fallacious which do not specify the kind of lamp black to be used.

There are two kinds; *Mineral Lamp Black*, and *Vegetable Lamp Black*.

Mineral lamp black is much the heaviest, and it requires a much larger proportion of it, by weight, to make an Ink of the same consistency than it does of vegetable lamp black, and is not suitable for Ink of a fine quality; but I have found in practice that it answers very well in certain proportions for inferior Ink.

It looks blacker in the powder than the vegetable black, but is not so when mixed with the varnish. It is in general foul, having extraneous matters in it, owing, I suppose to the material from which it is made, and to the process, and also to the lowness of the price not allowing the manufacturer to be at the trouble of cleaning it.

Vegetable lamp black is much lighter than the mineral, and that which is the lightest is estimated as the best. This article varies much in the proportions that are requisite to make Ink of the same strength; I have found that that which is sold in firkins takes by far the most varnish, and it is said to be the best that is made as an article of commerce. The price of this sort will allow it to be used only for

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fine Ink. There are still higher priced lamp blacks, which of course would be restricted to very select Inks.

If more then a just proportion of lamp black be used it will cause the Ink to smear, however long it may have been printed, and also set off under the bookbinder's hammer; and this effect must of consequence take place if the quantity be more than the varnish can bind: this fact shows that the thickest Inks are not always the best.

The process of making lamp black may be seen in Fertel's receipt, in that translated from the Encyclopédie, and also in that from the Printer's Manual, a French publication. In England they line the chamber in which it is made with coarse green baize or flannel, instead of sheep's skins with the wool on, as is recommended by the French writers.

Ivory Black.

Ivory Black is too heavy to be used alone as the colouring matter for black Printing Ink, but it may be used with great advantage, in a certain proportion, which may be ascertained by adding it after the Ink is made, and grinding it on the stone, taking care not to use too much at the first, for select purposes; for instance, if

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an engraving on wood is required to be printed in a very superior manner with black Ink, so as to produce the best effect that is possible, then ivory black, with the other ingredients necessary for the composition of fine Ink, will be found valuable. A difficulty, however, arises, of how it is to be procured, for the ivory black of commerce is not of sufficient blackness to produce this effect; and the printer will not be able to purchase an article that will answer the purpose.

The process by which this article, of the most intense blackness, may be prepared, and I have made it from this receipt, when it was as superior to the very best that could be bought as that very best was to the common ivory black of commerce, I shall now describe.

Provide a crucible, of a size proportioned to the quantity of black that may be required, and fill it with small pieces of ivory, which may be procured at table-knife cutlers, and are sold by the pound; the finest grained ivory I have observed makes the best black; close the top of the crucible with a cover that fits close, and that will bear a strong heat, or, in lieu of such a cover, close it with well-tempered clay; then place it in the middle of a hot fire, where every part of the crucible may be exposed to as equal

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a heat as possible, and let it remain till it is burnt to a charcoal to the centre; it should then be taken out of the fire and suffered to cool gradually. When the ivory is taken out of the crucible, it will be found that the outside of those pieces next to the sides will be burnt too much, and will be white, but the inside of them and that in the middle of the crucible will be of the most intense blackness. As the different pieces may vary in the intensity of the blackness, the most perfect should be picked out, any whiteness or discoloration on the outside be scraped off, and that selected reduced to a powder, when an article the most perfectly black that perhaps it is possible to make will be produced.

If it should happen to be wanted in a situation where a crucible could not conveniently be procured, enveloping the pieces of ivory with clay, and burning it as above described, will produce the same effect.

Prussian Blue.

This article used sparingly greatly improves Printing Ink, by giving it a greater depth of colour; but if the due proportion be exceeded it gives the Ink a coldish appearance. The best will be found to be the cheapest, as it goes

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further and produces a better tone than the common. It does not affect the working of black Ink, either in the smoothness or clearness of the impression, but it requires a great deal of grinding to make it fine.

Indigo.

This article produces the same effect as prussian blue, and may be substituted for it; or equal quantities of both may be used, which mixture, I think, produces a blacker Ink than when used separately. I am aware of the evils arising occasionally from the mixing of colours, but I have not perceived any bad effects from these two colours being used together in Printing Ink. I have not observed that indigo any more than prussian blue affects the Ink in its quality of working well.

Indian Red.

To give a rich tone to black Printing Ink, and to take away the cold appearance of the black when prussian blue and indigo are used, some additional colouring matter is necessary; and I have found that Indian red has answered the purpose remarkably well: it possesses a depth of colour of a purplish reddish-brown, which with prussian blue or indigo adds con-

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siderably to the intensity and richness of appearance of the Ink. It works free and clean, and the price of it is moderate.

Carmine or lake might perhaps produce a superior effect, but their high price precludes their use; and besides the lake of commerce does not possess sufficient depth of colour to give a richness of appearance to an intensely black Ink. This I shall notice when I come to treat of coloured Printing Inks, and give a receipt for making a lake of greater intensity of colour.

Balsam of Capivi.

This is a most valuable article, without any preparation, as a varnish for Printing Ink; but then it must be old, and pure. With this balsam, a due proportion of soap and colouring matter, and a stone and muller, any printer may at the moment make Ink of the most superior quality without any risk, and with very little trouble; the knowledge of which he may find of great service when he has any thing to print in a peculiarly neat manner.

It may not be improper to mention, to avoid disappointment, that I never purchased any balsam of capivi at an apothecary's shop that I could use as a varnish for Printing Ink: it was

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always thin and weak, and would not work clean; and the same complaint has been made to me by others who have used it on my recommendation. That which I purchased at Mr. Allen's, Plough Court, Lombard Street, London, never failed me; it was always of the same consistence, uniformly appearing to be the genuine balsam improved by age.

In the second volume of Aikin's Chemistry, Article RESIN, is the following account of it.

"Balsam of Capivi or Copaiba is a clear yellowish resinous juice, about the consistence of thin treacle, which flows in considerable quantity from incisions made in the bark of a large tree of South America, the *Copaifera Officinalis*.

"This balsam has a very agreeable smell and a pungent bitterish taste. It grows stiffer by long keeping, but never concretes into a solid. It dissolves totally in alcohol. When distilled with water it yields nearly half its weight of essential oil, and a brittle inodorous resin is left. It appears therefore to be a natural combination, simply of resin and essential oil."

This natural balsam possessing such valuable properties as a varnish in the preparation of Printing Ink, appears to point out to us that the next best composition for a varnish for this purpose, is that which approaches the nearest to it in quality; and our present varnish, when

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properly prepared, seems to approximate sufficiently near to answer every necessary purpose.

Canada Balsam.

This is also a natural balsam, and may be useful to a certain extent in the preparation of Printing Ink, but not so generally as balsam of capivi, as its properties are a little varied. It is much thicker, and dries sooner, than that balsam, which properties would prevent its being adopted alone as a varnish; but for a strong Ink, a small proportion may, perhaps, be mixed with balsam of capivi to advantage, and also with the regular varnish.

These natural balsams have so little colour that they do not affect the Inks whose tincts are light and delicate, and they also dry slowly, on which account there is no danger of the Ink made with them skimming over. This property, whatever opinions may be held to the contrary, is an advantage; for smearing is not attributable to this cause, but to too great a quantity of Ink being used, and that Ink containing too great a proportion of colouring matter, and also not being impressed on the paper with a sufficient power to fix it firmly on the surface, and this deficiency of power obliging the workmen to use a greater quantity to pro-

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duce the desired colour: but, when the materials are duly proportioned, it requires only a very small portion of Ink to coat the surface of the type, and when that Ink is firmly impressed on the paper by means of sufficient power exerted by the press or machine, the impression will not smear when it is just printed, in the usual way of handling it. Master printers are anxious at the present day to procure an Ink that will dry immediately, but if this property were given to it, they would be again disappointed, for the Ink would work foul, and the workmen would neither be able to produce good work, nor to proceed with despatch, as the form would require to be washed frequently, as was the case before soap was used—in short, I hold that it is impossible to produce an Ink that will dry very quickly and also work clean to enable the pressman to proceed with his usual quickness.

I use the word machine, as implying cylindrical printing, with steam as the moving power generally, in contradistinction to press, which is worked by manual labour.

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Implements.

It is necessary to have an iron boiler, of a capacity to contain at least double the quantity of oil that is meant to be boiled; as I would never venture to make varnish with the boiler more than half full of oil, on account of the risk incurred of its rising and boiling over the top; in fact, one third full would be safer, and cause the oil to be more manageable in case of an accident.

The iron boiler must have three feet, and may be set on three bricks, to raise the bottom from the ground, so as to enable the fire to burn, and surrounded by a circle of bricks, to keep the fuel from spreading about, and to confine the fire under the boiler; it should also have two lugs, either to suspend it over the fire by means of a bow, or to lift it off the fire by means of iron hooks when set on bricks, when it is necessary. It may be suspended over the fire by the bow with a hook at the end of a chain affixed to a triangle.

The boiler should have a cover made to fit close but not tight, so that it may be put on and taken off with facility. It should have a handle at the top, by which it may be taken off with a stick; for after remaining on the boiler

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some time, for the purpose of extinguishing the flame, it will be found too hot for the hand. This cover may be made either of ironplate or tinplate.

An iron spatula should be provided, to stir up the oil during the process, as well as to take out a few drops, from time to time, when it is necessary to try its consistence, and to stir it up when the rosin and soap are added; as also to mix the colouring matter with the varnish.

It will also be necessary to have an iron ladle, large in proportion to the quantity of oil boiled at one time, with a long handle, to take out a portion if the oil should rise and be in danger of running over, from having too brisk a fire, as I shall describe in treating of boiling the oil; and it will also be requisite to lade the varnish out of the boiler, when it is completed.

A stick, about a yard long, with a cleft in one end will be found useful, when the oil is in a state to burn; as by putting a piece of paper in the cleft the oil may be set fire to without any risk of burning the hands or face.

Neither should a piece of slate, a plate, a tile, or a few oyster shells be forgotten, to put a few drops of the oil on occasionally, in order to ascertain when the oil is sufficiently boiled and burnt.

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CHAPTER IV.

ON THE PREPARATION OF BLACK PRINTING INK OF DIFFERENT QUALITIES.

After having thus gone through the preliminary matter which appeared to me necessary to clear the way to the subject of making Printing Ink, including the directions of those who had previously written on the subject, which the reader will perceive are of no value, but which will enable him to give them a trial if he thinks proper, I shall now proceed to give the results of my own experiments; and I feel justified in saying that I am the first person who has treated this subject in a practical way, and laid before the Public the qualities of the different articles, and the process by which Printing Inks may be prepared — from that which is proper for book work generally, to

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that of the finest quality — without disguise or reserve.

I shall in the first place treat of black Printing Ink, then of coloured Printing Inks, and lastly I shall briefly observe on those Inks that change colour on the application of an acid, and which are used for Cheques on Bankers, &c. to prevent any fraudulent alteration.

Printing Ink for General Purposes, superior to that usually sold at Two Shillings and Sixpence a Pound.

Having previously described the materials, and the apparatus necessary for boiling the oil, I shall now proceed to the process of making the varnish, and afterward to preparing the Ink; taking the proportions for a small quantity that would be easily managed, and would be convenient to printers in general.

A boiler being placed upon three brickbats, and surrounded by a circle of bricks, to confine the fire, placed a little apart from each other, to admit a current of air to the fuel, put into it six quarts of linseed oil, then light a coal fire, using plenty of wood in order to make it burn briskly, and keeping it up lively and steady,

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but not very violent. After the oil has been some time on the fire, it begins to simmer, and small bubbles arise; it soon after has the appearance of boiling, and the bubbles increase in number; but as the oil gets hotter this appearance ceases; the bubbles disappear, and the surface becomes smooth and unruffled: after this it begins to emit smoke; it begins to boil, and it smells very strong; and if the boiling be prolonged a scum arises: it should now be carefully attended to, and frequently tried with a piece of lighted paper, to see if it will take fire, which it will not do in this state, unless the flame of the paper be carried down to the surface of the oil.

It is a considerable time before it will take fire, but after the smoke begins to arise it should be tried frequently, as it is more manageable when taken as soon as it will burn. When the vapour begins to be inflammable, it takes fire with a few flashes, which may be distinctly heard, although not seen, and these flashes immediately clear away the smoke. In a little time these flashes become stronger, may be seen, and continue flashing a short time: I would now advise that it should be taken off the fire and placed on the ground, set on fire and kept stirring with an iron spatula, which exposes

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fresh surfaces to the atmosphere, and keeps the flame in. This burning increases the heat of the oil, and also increases the flame, so that it will be necessary to cover it occasionally, for the purpose of extinguishing the flame, and trying its consistence. This may be done by dipping the spatula into the oil, and dropping a little on an earthen plate, &c. which will soon cool. If it do not draw out into strings, on touching it with the finger, set fire to it again, and keep repeatedly trying it, and continually stirring it up with the spatula; when it will draw into strings about half an inch long, on touching it with a finger and withdrawing it from the plate, it is burnt enough for an ink sufficiently good for book work generally; the cover should then be placed on the boiler, and the flame extinguished.

If the oil be pushed to a violent boiling heat in the first instance, without trying if it will take fire, the probability is that it will froth so much and rise up in the pot, as to take fire spontaneously by contact with the atmosphere, and become unmanageable, and baffle all attempts to extinguish it, endangering the safety of the building, if within one, and the adjacent ones, and the wasting of the oil. Under these circumstances, when they occur, a large sized ladle

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will be found peculiarly serviceable, as a large portion of the oil may be taken out of the pot into the cool ladle, and by taking some out and pouring it into the pot again repeatedly it will rapidly cool, and the oil may thus be saved; and if a few small pieces of soap can safely be introduced without making the oil run over the top of the boiler, it will cause the rising to subside, and thus prevent loss and danger.

I have used a wooden cover to a boiler, made to fit very close, which answered the purpose very well two or three times; but at one time, boiling the oil with a strong fire, it suddenly burst into a violent flame, which set all my endeavours to extinguish it at defiance; for it burnt so furiously, that it boiled over, set the wooden cover on fire, and the ground was covered, all round the boiler, with a liquid fire, spreading in all directions in a most alarming manner. I had, as soon as the cover was put on, got it off the fire, by putting a long piece of wood through the bow, and two people lifting it on the ground; throwing water on the burning oil caused it to burn more violently, so I poured water on the ground plentifully, and surrounded the oil with it, so as to prevent the fire spreading, and it thus burnt itself out, without doing any other harm than wasting the oil.

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The residuum, when cold, had the appearance of Indian rubber, was very sticky and elastic, very tough, and was very difficult to cut with a knife.

I mention this circumstance more particularly, to show how necessary it is to be cautious in boiling oil; how difficult it is to extinguish it when it is burning violently; and the necessity of great care and attention in this part of the process; and that the cover should be made to fit accurately, and be always at hand; for if such an accident were to take place within a building, it must inevitably be destroyed.

When the cover is taken off again there is a great quantity of smoke, that has a powerfully disagreeable smell, and a deal of froth: when this froth has subsided by stirring it well together, six pounds weight of amber rosin, or black rosin, should be gradually put into the oil, and stirred up: if it were put in at once the effervescence would be so great, that the oil would run over the top of the boiler.

When this is done, and the rosin dissolved, which the heat of the oil will do, there should be added one pound and three quarters of dry brown or turpentine soap of the best quality, cut into slices: this also should be put in gradually and with caution, for it causes a violent

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ebullition, and as the soap dissolves it is thrown up to the top, and forms a kind of froth to a great extent. When all the soap is put in, and the ebullition has ceased, it may be replaced over the fire till it boil, which it will soon do, and the varnish will be completed.

While the rosin is being put in, it is advisable to keep stirring the oil with the spatula; the same when the soap is put in, and also when over the fire for the last time, that the whole may be intimately and uniformly incorporated.

Then take five ounces of the best prussian blue or indigo, or equal weights of each to the same amount, reduced to a powder, and put into an earthen pot or a tub, large enough to contain the whole quantity of Ink when all the ingredients are mixed together.

Into this vessel also put four pounds of the best mineral lamp black and three pounds and a half of good vegetable lamp black, then add the varnish, little by little, while warm, and keep stirring it well together, till the whole of the varnish is put in; the stirring of the ingredients together should be continued till they are well mixed and no lumps remain: it should then be submitted to the levigating mill or to the stone and muller, and ground to an impal-

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pable fineness, and the Printing Ink will be fit for use.

It will be found that if the varnish be cold when the lamp black is added, a great deal of trouble and loss of time will be occasioned by the difficulty of mixing them; but if the varnish be warm or tolerably hot they may be mixed much more readily and with comparatively little trouble.

This Ink has been compared with the Ink of commerce of a celebrated manufacturer at Five Shillings a pound, both as to working and colour, and was pronounced to be fully equal to it in both particulars.

A fine Printing Ink prepared from the best Ink of Commerce.

Among other fine and splendid works entrusted to me to print, was "The British Gallery of Engravings, by the Rev. Edward Forster," and I was required to execute this work at least equal, but if possible superior, to any work that had been produced in England. This was in 1807. I then found it necessary, in order to satisfy this requisition, to turn my attention seriously to the improvement of Printing Ink; for no fine Ink was to

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be purchased from the manufacturers, their best being comparatively of an inferior colour, and of a weak consistence. The finest printers in England had obtained their celebrity solely, in my opinion, by the superior quality of their Ink, — for there were others who possessed as good practical knowledge in the art; — and these fine printers, as they were termed, for they were few in number who had obtained this distinguished appellation, were in the habit of improving the Ink of commerce, which improvement they kept a profound secret. In this state was the art of printing when I commenced my researches, and instituted a series of experiments for the improvement of this article, the results of which are detailed in these pages.

As the basis to work upon, I took Blackwell's best Ink, for which I paid five shillings a pound; and, after repeated experiments, I made the following mixture, which I shall copy from my original Memorandum, made at the time; viz. on the 12th of July 1808. With this Ink Nos. 1, 2, and 3 of the above-named work were printed.

I mention this circumstance that they may be a reference to the quality of the Ink, and how it retains its colour.

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" 1 lb. of Blackwell's Ink, at 5*s*. a pound.
1¼ oz. of the best prussian blue.
¼ oz. of mastich varnish.
½ oz. of balsam of capivi.

" These ingredients were ground on a marble with a muller, till they were intimately blended and made as fine as possible; and I have never seen any Ink superior to it, in my opinion, either for colour, for producing a fine clear impression, or for working clean, for fine work."

This observation, it will be recollected, was made in 1808.

The execution of this and other splendid works raised the productions of my press to at least a level with the best contemporary printers; and I have had the gratification of witnessing my employers comparing my printing with that of those who had acquired the highest name, and awarding to me the superiority.* I thus, by perseverance, completely

* It may not be irrelevant to give the following extract from the Monthly Magazine, for 1807, vol. 24, p. 585, which formed part of the review of the British Gallery of Engravings: —" The Letter-press of this work is in the most superb style, and rivals the celebrated Horace by Didot. It is from the press of Mr. W. Savage of Bedfordbury, and does him the highest honour."

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succeeded both as to Ink and workmanship; the latter of which was executed at a wooden press of the common construction, the platen being enlarged, so as to make it a one-pull press.

I am perfectly aware that what may be styled egotism pervades this book; but when I consider that I am laying before the public the results of my own practice and experience; that I am criticising the receipts of others; and that I am the first who has treated at any length on this subject, I feel that I could only write in the first person; for, as I am neither theorizing nor availing myself of the knowledge of others, I wish to impress upon the minds of my readers that the subject on which I am treating is one to which I have devoted a great deal of application.

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Printing Ink of a very superior Quality, without Oil or Rosin in its Composition.

After persevering in making experiments for a series of years, I at last accomplished the object which I long had in view, of making Printing Ink of the most superior character without any oil in its composition; thus getting clear of the imperfections of inferior or adulterated oil; of over boiling or under boiling; of inaccurate proportions of rosin; and of the trouble and danger of boiling the oil.

The Ink which the following receipt is for producing, is a fine and intense black, and works as freely and clean, looking at it as a strong ink, as can well be wished for; and washes easily off the types. It received the free admiration of Messrs. Bensley and Son, who had a supply of it for their very finest work. This Ink surpasses by far any that I have ever seen manufactured for sale, lying smooth on the surface of the paper —not sinking through the paper, nor tinging it in any way,—not spreading at the edges—and retaining its intense blackness; for I have some before me that has been printed fifteen years which is unchanged, and has precisely the same appearance as when it first issued from the press.

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Proportions for One Pound of superfine Printing Ink, without Oil or Rosin.

Balsam of capivi . . .	9 oz.
Lamp black	3 oz.
Indigo, or prussian blue, or equal quantities of both . . .	1¼ oz.
Indian red	¾ oz.
Turpentine soap, dry . . .	3 oz.
	17 oz.

To be ground upon a stone with a muller to an impalpable fineness, when it will be fit for use.

The lamp black to be of the best quality; I used that which is sold in firkins. (See p. 113.)

This receipt for making a Printing Ink of a very superior quality, without either oil or rosin in its composition, will I believe be found of importance to every master printer who executes fine work, or highly-finished engravings on wood, as he may prepare it himself without the least risk, and with no more trouble than would be equal to grinding a little oil paint, and thus keep a small quantity in a tin can ready for use at any time; or in case of emergency it can be prepared in half an hour.

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Printing Ink of a superior Quality, the Varnish made with Oil.

Balsam of capivi having a peculiar smell, which the Ink made with it will retain for years, and becoming more powerful when held near the fire, some persons may prefer a fine strong Ink without any peculiar scent; in which case it will be necessary to boil and fire the oil to a higher degree than I have described for an Ink intended for general book work, so as to make a stronger varnish to prevent any fear whatever of the oil separating from the colouring matter and staining the paper. This varnish will of course require a small proportion more of soap to make it work well and clean. Substituting this varnish for the balsam of capivi, the receipt will stand with regard to the articles and their quantities precisely the same as the last.

There are various reasons why strong varnish is used in fine Ink for superior work: — the oil being well boiled and fired, acquires a tenacity that, when combined, with rosin, prevents its spreading and staining the paper; the form requires to be well beat with it, that the face of the type or engraving may be completely

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coated, which it will thus be with the least possible quantity of Ink; the surface only is thus coated, and no superfluous quantity is present to squeeze or run over the edges and disfigure the work, and an impression is obtained of the surface only of a full rich colour, which should always be the object in fine work. It acts also as a preservative to the colour of the Ink, and thus continuing unimpaired the beauty of the workmanship.

On the first general promulgation of printing in Europe, for I cannot allow it to be the invention of the art, Fust and Schœffer's presswork and Ink were of a superior quality; and their Bible, which is generally styled the "Mentz Bible without Date," and also the "Psalter of 1457," would rank as fine works at the present day; and some of the ornamental letters in the Psalter, in coloured Inks, are so well printed that most of our pressmen would be baffled in an attempt to imitate them successfully, if it were now required to copy them. I have examined different copies of these books, and admired the black Ink of the Bible, and the red Ink of the Psalter, which have preserved their richness and brilliancy of colour for nearly four hundred years.

I have also examined some of Coster's pro-

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ductions from the Harlem press, which are supposed by many to be anterior to those of Fust and Schœffer, and the black Ink of one of these works is also a good black unimpaired by time.

The "Speculum," which is supposed to have been printed about the year 1440, is in two columns; the Ink is of the most intense blackness, and the presswork of a quality that would be called good at the present day. At the head of each page is an engraving on wood, executed as a fac simile of a pen and ink drawing, and printed with an umber coloured Ink; and so correctly is this appearance given, that at first sight they have all the effect of drawings made with a pen and writing ink, in which the ink has turned brown with age.

It appears to me that the cause of this preservation of colour arose from those early printers using a stronger varnish than we do in Ink for general use; and I draw this conclusion from the appearance of the works themselves, which tends to corroborate the opinion I have just expressed in the reasons for using strong varnish for fine Ink.

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CHAPTER V.

ON COLOURED PRINTING INKS.

I COME now to a portion of my subject that invariably baffled all Printing Ink makers and printers who attempted any letterpress in colours, where the workmanship was required to be of good quality, until my work on "Decorative Printing" was published, which caused a great revolution in this department of the art.

I know of two instances which occurred before that period, where two printers in London, eminent for their skill and abilities, were completely baffled, and could not print some subjects in a brown Ink, to meet the authors wishes, to their great disappointment, and the printers mortification; the difficulty has been removed by the appearance of that work; but as the number printed was small, and the work

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expensive, it is not generally in the hands of printers.

It will be found that different colours will require different proportions of soap ground up with them, to cause them to work free and clean; and the utility and absolute necessity of this article in Printing Ink having been kept a profound secret by the few persons who manufactured the article for sale, and were interested in keeping the secret, prevented any great competition; and also prevented many ingenious printers from ornamenting their productions with colours, as the varnish which is sold was found not to be sufficient of itself to make even vermilion, the colour most commonly used, to work clean, and beyond this there was no resource; for self interest locked up closely the only known remedy.

Another reason for this deficiency of decorating the productions of the printing press by its own powers, appears to me to proceed from the general want of knowledge among printers and Printing Ink makers of colours and their application to imitating works of art by means of the press; and this formed an additional shackle which required to be broken.

I have seen coloured Inks offered for sale with high-sounding pretensions, which betrayed a

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complete ignorance of the subject on the part of the preparer: for instance the blue was made from prussian blue; and all the lighter shades were produced by the addition of white lead, in smaller or larger proportions according to the shade required: now I have found in practice that mixing white with any colour to produce a lighter tinct invariably deadens the colour and destroys its liveliness and brilliancy, when it comes under the pressure of the platen; and it is a notorious fact that white lead is not a permanent white, but on the contrary, for the metal revives by exposure, and changes to a black hue; and I have some proofs by me of engravings on wood that were touched by the artist with white lead, as directions to the engraver, that have the appearance of being daubed with palish writing ink, owing to the revivification of the metal.

These Inks also skinned over after standing a few days, similar to oil paint, owing to a want of soap in their composition; the preparer of them being evidently ignorant of the necessity of its presence to cause the Inks to work clean. The result was that the Inks dried up and could not be used.

This is one among others that I have witnessed of the complete failures that have taken

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place in consequence of following the directions given by Breton, Papillon, and those who have ignorantly republished their receipts for making Printing Ink with undeserved commendation, without having taken the trouble of ascertaining their merits or demerits.

I would advise printers to have in readiness a small marble slab and a small muller, with some good Printing Ink varnish; they may thus immediately prepare a coloured Printing Ink when wanted with little trouble or inconvenience, and of any colour or tinct that is required, by reference to the following list; and if they find any Ink accumulate on the face of the type so as to clog it up and prevent it working clean, a little soap rubbed into the Ink with the muller will immediately remedy the defect. I would recommend curd soap for this purpose, for being white it will not affect the colour where a delicate tinct is required.

When a light washy tinct is required, I would strongly impress on the printer not to reduce the colour by the admixture of any white with it, which will take away all its liveliness, and produce dullness; but to thin it with varnish to the point required; to beat the subject with very little Ink; and to apply a very strong pressure, by which means any tinct may be

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produced that the colour is capable of, still retaining all its spirit:—

I have found in practice, that, whatever varnish may be used, some colours sink through the paper and stain the back of it more than others; this is owing to the solubility of the colouring matter in the varnish, which thus penetrates through the paper. It is therefore advisable in imitating drawings to avoid such colours as much as possible, and where it is not possible, to print on India paper, and mount them; for where it happens it disfigures them greatly, whether they are bound in a book or preserved in a portfolio. It is a curious fact that this action does not take place in thin white India paper, the back remaining unaffected.

After having premised thus much, I shall now proceed to enumerate the different colours that may be used for Printing Ink, describe their properties and the manner of preparing them, and add some observations that may be useful to those who have work to execute in colours.

RED.—The best contrast with Red is Green.

Carmine.—This is a more brilliant colour than lake, and possesses more depth; it is readily ground into a fine Ink. I should

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strongly recommend balsam of capivi to be used as a varnish when carmine is employed as a Printing Ink, on account of its paleness, as I should be afraid of the deeper shade of printing ink varnish deteriorating its brightness. Carmine is too expensive to be used as a Printing Ink except for very particular purposes. I have been accustomed to pay for the best two guineas an ounce.

Lake.—There are two sorts of lake in commerce — crimson lake and purple lake; the crimson lake is the richest colour, and is to be preferred, for a purplish tinge may easily be given to it when required, but the crimson tone could not be given to the purple lake. It is easily reduced to a fine Ink with the muller; it works clean, and does not require more soap than varnish contains. It is a colour that does not possess much depth.

As it may be necessary sometimes to use this colour of a deeper tone than that which the lake of commerce possesses, I think I shall be doing a service by giving a receipt, which has not, to my knowledge, been published before, for making a very superior lake, of a much more powerful colour than can be purchased.

Take one ounce of the best cochineal, powder it, and boil it in one quart of water, till the

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colouring matter is extracted; then let the cochineal subside, and pour the liquid into another vessel; when cold, pour into this decoction gradually some muriat of tin, and keep stirring it; the muriat of tin immediately changes the decoction into a most beautiful colour; be cautious in the first instance of not putting in too much of the muriat of tin: let it subside, and if the supernatant liquor be nearly colourless, there is a sufficient quantity of the muriat of tin; if it still retains any considerable portion of colouring matter, a small quantity more must be added, but I would not advise so much as to precipitate every portion of the colour in the supernatant liquor; when this is done, add a little powdered alum, and assist its dissolution by occasionally stirring. Let it subside, then pour off the greatest part of the liquor, and wash the colour well in three or four waters; this is done by adding a considerable portion of the purest water you can obtain, stirring it up well each time, and when the colour has subsided pouring as much water off as you can without disturbing the colour; as the colour subsides, keep pouring off the water; by this process the colour is divested of the acid in the muriat of tin; then dry the precipitate gradually with as little heat and

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dust as possible, and a lake will be produced far deeper in colour and superior to any that can be purchased in the market—in fact it may be termed a fine carmine.

During the process of making it the addition of salt of tartar will give it a purple tinge.

Vermilion.—This colour is generally employed as the colouring matter for red Ink that is used for jobs of a neater appearance than common, and for title lines in books. Its properties and appearance vary much in different specimens. Chinese vermilion is estimated to be the best, and it is the brightest. It requires a large proportion of soap ground up with it to make it work clean, and Chinese vermilion more than the vermilion of commerce; but the exact proportion can only be ascertained at the press side when using it, as different specimens require different proportions: if it does not leave the type clean after a few impressions, but begins to accumulate and clog the face, a little more soap should be rubbed in; if the surface of the type be left clean, but the Ink spreads over the edges, there is too much soap in it, and a little more colour and varnish should be added; by attending to these suggestions, red Ink formed with vermilion may be made to work as clean and well as black Ink,

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as I have repeatedly experienced in my own practice.

Preceding writers on this subject have recommended the addition of lake to vermilion, for the purpose of producing a brighter colour than vermilion alone would produce; but I have invariably found that instead of brightening it injured both the colours, and produced a brick-dust dull effect. A much brighter red will be produced by taking Chinese vermilion and adding a small portion of chromate of lead. But the greatest improver of a colour is a good contrast. This colour is apt to turn black by exposure to the atmosphere.

Red Lead.—This article is inferior to vermilion, but is much used in posting bills, where cheapness is required; it may also be found useful where a variety is wanted of a paler colour. It requires a greater proportion of soap than is in the varnish, to cause it to work clean. It soon changes colour, and turns black.

Indian Red.—This colour is of a deep reddish brown with a purplish cast; it is tedious to grind it smooth, being hard and refractory under the muller, but when ground to the proper fineness it makes a good Ink of a rich tone, and works well. It is valuable in its combinations with other colours, both in mix-

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ture and contrast, as well as in its unadulterated state. It is capable of much intensity, and would, in my opinion, be superior in many instances to vermilion for effect, and would prove a good variety for jobs, titles, head lines, &c. The colour is permanent.

Venetian Red.—This colour is easily ground into a smooth Ink, and does not require much more soap than varnish generally contains. It makes a red Ink not of much intensity, but not without its value, as affording a variety of colour at but little expense.

Rose Pink.—This is a very cheap colour, and its cheapness may induce some printers to try it where economy is requisite; but except they succeed better than ever I was able to do, they will lose the colour, the varnish, and their time; for I have tried it in every way that I could think of, and I could never make it work clean, nor even make decent work with it. The result is, that I pronounce it to be a worthless colour for Printing Ink. It is also a very fleeting colour. I only mention it as a caution to prevent disappointment.

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ORANGE.—The best contrast with Orange is Blue.

Orange Chromate of Lead.—This variety makes decidedly the best orange coloured Ink. It is ground smooth with very little trouble, and forms a good working Ink of a brilliant hue, and capable of producing a most showy effect when happily contrasted with other colours.

Orange Lead.—This is a paler but warmer colour than red lead, and may be useful as a variety in large bills where economy in the price of the Ink is necessary. It requires an additional quantity of soap to what is contained in the varnish. It is by no means a permanent colour. None of the preparations of lead are to be depended on, as they all change colour.

Burnt Terra di Sienna.—This is a useful article where a warm yellow tint is required, or to shade yellows with. It works clear and clean, but requires an additional portion of soap. It is a permanent colour, and makes a smooth Ink; but it must be remembered that as this is a transparent colour rather than a body colour, its use is more appropriate in imitations of drawings or ornamental productions than with types.

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YELLOW.—The best contrast with Yellow is Purple.

Chromate of Lead.—This is the brightest yellow as a body colour that is yet known. It is easily ground into a fine Printing Ink, and it works freely and well, and requires little or no addition of soap beyond what is contained in the varnish. There are different shades of this article, from a pale yellow to an orange colour. This colour united with indigo makes a powerful green; with prussian blue a brighter, but less intense; with Antwerp blue a brilliant green; all of them working well. It must always be kept in memory that the purest yellow, that is, that yellow which has least of the orange tinge, will produce by far the brightest green.

Indian Yellow.—It is a transparent colour; and will be useful in glazing, and where a rich mellow tone is required in imitating a coloured drawing of a landscape.

Gall Stone.—It is a transparent yellow of a peculiar warm tinct, and will be found useful in glazing rich mellow tones in landscapes. It is a concretion taken from the gall-bladder of cattle that are slaughtered; and the great supply is obtained from the government yards. It is apt to fly.

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Gamboge. — Although a bright yellow as a water colour, yet gamboge used as a Printing Ink possesses no merit, except in imitating drawings, when it may be used as a light washy tint where much effect is not wanted; but for a full yellow it will not answer. The colour stands well.

King's Yellow. — This is by no means a bright colour, and it has besides a disagreeable smell; yet it was the only article used where yellow Printing Ink was required till I introduced chromate of lead as the colouring matter, which is so much superior that king's yellow is entirely superseded. Does not stand.

Patent Yellow. — This is a colour that will not be of much use as a Printing Ink, possessing little body and that of a dull hue. Where bright tints are required it is worthless.

Roman Ochre. — It possesses a deeper tone than yellow ochre, with which it may be used as a shade in representing stone buildings, and in foregrounds of landscapes. It is dearer than yellow ochre, but the latter article may be easily brought to the same shade by burning.

Yellow Ochre. — In the representation of stone buildings, yellow ochre will be found a useful colour. It is easily ground into a fine Ink. It is dull, but stands well.

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GREEN. — The best contrast with Green is Red.

Verdigrise. — This article makes an Ink of a bright green colour with a very slight bluish tinge, which may be useful in large bills, where variety, show, and effect are required for temporary purposes; but care should be taken that the verdigrise be of a good quality. It does not form a good working Ink; in fact it would be almost impossible to produce an even surface, though when seen at a distance it produces a dashing effect. It is a very fleeting colour, and on these accounts unfit for general purposes.

Green. — Green Ink may be made with an admixture of blue and yellow, and the choice of the materials must depend on the shade and tinct of green that is wanted. Prussian blue and chromate of lead make a good rich green; indigo and the same yellow a deeper duller colour; Antwerp blue with it forms a brilliant and rich green; and thus greens of every hue may be formed with different blues and different yellows. It is necessary to observe that the purest yellow chromate of lead must be selected if a bright green be required; for that which is of an orange or reddish tint will invariably produce a dull green colour. The colour of any green Ink may be deadened by the addition of a little lake.

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BLUE.—The best contrast with Blue is Orange.

Indigo.—This substance is a deep blue, but does not possess much brightness; it is a powerful colour, and may be used as a shade to prussian blue, for when it is printed upon that colour it appears like a deep blue black. It requires a great deal of grinding to make a smooth Ink. It is a cold but permanent colour.

Prussian Blue.—This is a deep bright colour, and makes a good Ink for large bills where variety is wanted for the sake of effect, and also to form deep greens. It requires a great deal of grinding to make a fine Ink, and an addition of soap to the varnish to make it work well and clean. This blue is far superior to either indigo or Antwerp blue,—being free from their greenish tinct,—in the composition of the various shades of peach, violet, and plum colours, and purple.

Light Prussian Blue.—When this article is procured of a good quality, it forms an Ink of a bright blue, and of a lighter tinct than prussian blue, as its name implies. It makes a good Ink as a variety in large bills; and for other purposes where the colour is suitable. It may be distinguished from Antwerp blue by not having the green tinge which always identifies that colour.

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Antwerp Blue.—This is a bright light blue colour with a slight tinge of green; it forms a good Ink, works clean and well, and is easily ground to a proper degree of fineness; and makes a good contrast where a lively appearance is required: I have already said that it produces when mixed with chrome yellow a green of great brilliancy.

Cobalt Blue.—In the powder this is a most beautiful and rich blue, but when made into an Ink it loses all its brilliancy under the platen and produces a dull colour that is of little worth.

PURPLE.—The best contrast with Purple is Yellow.

Purple Inks of different shades and tincts may be made by grinding together carmine, or lake, (purple lake for this purpose is the best,) with prussian blue. Indigo or Antwerp blue produce a far inferior colour.

BLACK:—

Indian Ink.—For the imitation of a drawing in Indian ink it may be used, but for the greater depths an Ink cannot be made with it of sufficient blackness; for them it will be necessary to use good black Printing Ink. Upon the whole it will not be found particularly useful.

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Lamp Black. — For general purposes good black Ink is the best article to use when black is required; but in imitating drawings the colours that are used in black Ink to give it intenseness may produce an undesired change in those in the picture; in this case lamp black is preferable. Light shades of lamp black are better than diluted black Printing Ink, as the latter becomes neutral when weakened with varnish. It stands well, but is not very deep.

Ivory Black. —When an intense black is required, free from the admixture of other colours, a small portion of Ivory Black, prepared as directed at page 115, mixed with the best lamp black will produce the desired effect. It is a cold colour.

BROWN :—

Bistre. — Bistre forms a useful brown, in the ground, in trunks of trees, and in shades. It is an obstinate colour under the muller, and requires a great deal of grinding to make a smooth Ink. Jackson used it extensively in his large Scripture prints which he copied from the pictures of the old masters in the churches in Italy, and engraved on wood, on blocks *en suite.* It is prepared from the soot of chimneys

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in which wood has been burnt, and well washed. It stands well.

Raw Umber. — This is not so warm a brown as burnt umber, but is more of an earthy colour; and is useful in foregrounds of pictures and as a shade, and in many other cases. It stands well.

Burnt Umber. —This is browner than either bistre or raw umber, and is useful by itself as well as to mix with other colours where a lively tone is not required. It works well, has more intensity than bistre, and is permanent.

Sepia.—This is a colour that is much used in water colour drawings in preference to Indian ink; possessing more richness and depth than that article. This brown has a tinct peculiarly its own, which cannot be successfully imitated by a compound colour. It makes a good working Ink, and may be used with advantage and effect both in the imitation of drawings, and as a variety where black is not required.

Brown.—In addition to bistre, raw umber, burnt umber, and Venetian red, deep and rich browns may be compounded of other colours far superior to any of these:—vermilion and black Printing Ink make a very good brown, which can be varied to any tinct that may be wanted; lake and burnt umber make a pecu-

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liarly rich brown; but the richest that I have ever seen in a Printing Ink, and I am not aware that any person but myself has formed it, may be made of lake, prepared according to the receipt given in this chapter under the article *Lake,* Indian red, a small proportion of indigo, it being a powerful colour, and a little chromate of lead. For finely executed engravings on wood I think this brown Ink, when the different articles are well proportioned, produces a superior effect to the best black Ink, for richness and delicacy.

Prussiate of Copper.—This is a rich brown in oil painting, but the pressure of the platen detroys all its richness; and as a Printing Ink it becomes an inferior dull brown.

I am convinced by the result of innumerable experiments made during my long practice in this department of the art of printing, that every colour that is applicable to oil painting may be used as a Printing Ink; but it will be found that the great pressure applied in the process has the effect of making the colour duller than it would be in painting, either in oil colours or water colours.

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CHAPTER VI.

ON PRINTING INKS THAT CHANGE COLOUR ON THE APPLICATION OF AN ACID.

It has been considered to be a desideratum by merchants and bankers to have their blank draughts printed in such a manner as to prevent any alteration being made in them, by designing and unprincipled persons, when filled up, by altering the amount of the sum, without certain detection; this has been effected, but the knowledge of the preparation of the Ink has been kept a profound secret by one house in the city of London, who monopolized the business for many years.

The method of preventing any alteration passing undiscovered by the cashier of a bank, &c. has been produced, by fabricating a Printing

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Ink that would immediately change colour on the application of an acid that might be employed to discharge the writing; so that when it was attempted to obliterate the sum written in and the figures by means of an acid, for the purpose of inserting a larger sum, the Ink with which the draught was printed should immediately change colour and expose the attempt.

To make this object still more certain, I would suggest, in addition to printing the blank draught and a few parallel lines in one corner for the amount in figures only in changeable Ink, to cover the whole paper with a fine and delicate lace pattern, printed with a light coloured Ink, and upon this ground to print the draught with a black Ink, both of them changeable on the application of an acid, so that no attempt to obliterate the writing could be made without affecting the ground pattern, even if the writing should be clear of the letters of the printed part of the draught, and thus any attempt to alter the sum, or to effect any change in it would become visible and apparent, and render detection inevitable.

It does not appear to me at all reasonable that a plan of this nature to prevent fraud should be confined to bankers' draughts only,

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nor why it should not be extended to bills of exchange and receipts, by covering the paper with an elegant ground pattern of a light colour, to prevent alterations, which would also give them a tasteful appearance. It would also prevent any erasures or alterations being made by scratching the writing out with a knife, and thus be the means of preserving the instrument in its original state.

In making experiments on this subject it should be kept in mind, to prevent disappointment, that all colouring matters used should be such as an acid will act on so as to change the colour; now for black Ink the two carbonaceous substances that are generally used in Printing Inks—lamp black and Frankfort black—remain unchanged by the action of an acid; of course they must be discarded from entering into any composition for this purpose. The strong varnish used for black Printing Ink is impervious to the acid, and locks up the colouring matter, so that it remains unaffected; this varnish must also be discarded as useless in the process.

For a black Ink we must therefore have recourse to some other substances; and we shall find what will answer our purpose in galls, iron, and logwood. The varnish must

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be weak, and an increased proportion of soap in it, which will render it permeable to the acid, and enable it to act on the colouring matter and to change its appearance, and thus render any attempt at deception plainly perceptible.

I state these as general principles to be kept in view in all experiments made to improve or extend this method of printing, which has for its object the prevention of fraud.

Receipt for a Black Printing Ink that will change Colour on the Application of an Acid.

Make a strong decoction of the best nut galls in water, having previously broken them into small pieces; when well boiled strain the decoction from the galls, and put to it about an equal quantity of a strong decoction of log-wood, also strained from the chips; add some green copperas-which will precipitate a black powder by combining with the gallic acid of the galls, and also add some powdered alum which will combine with and precipitate the purple colouring matter of the logwood, which gives richness and intensity to the black pre-

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cipitate of the galls and copperas; stir them well together frequently till the copperas and the alum be dissolved, then let it subside, and as the supernatant liquor becomes clear pour it off, dry the precipitate, and there will remain an intense black powder.

Then take two parts balsam of capivi and dilute it with one part spirits of turpentine, and add a good proportion of dried soap, put to these articles as much of the black powder as will make the mass of a proper consistence for a Printing Ink, grind them to an impalpable fineness, and the Ink will be fit for use.

I have had specimens of this Ink tried in a copper-plate printing office where an extensive business was carried on, and the workmen were ignorant of what the Ink was, or for what purpose it was tried, and they reported that it spread well on the plate, and wiped readily off; the impression was clear and delicate, and intensely black; and an impression that is now lying before me (23d November, 1831,) which was printed on the 2d of June, 1823, is unchanged. On the application of oxalic acid it changed colour in the same time and in the same manner that writing ink did on applying to it the same acid.

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A Crimson Printing Ink that will change Colour on the Application of an Acid.

I have used the lake of commerce ground up with varnish and a large proportion of curd soap, to print a fine pattern to write the amount in figures and the signature on in a banker's cheque, and no Ink could work freer or cleaner; and on the application of an acid it immediately changed colour.

These experiments were made by myself, and completely succeeded; and I have not the least doubt that every colour that can be used as a Printing Ink, provided it will change colour on an acid being applied to it, will answer this purpose. Colours produced from vegetables, generally speaking, are the most susceptible of change; thus we might obtain, in all probability, a variety of tincts from Brazil wood, fustic, galls, logwood, madder, oak wood, woad, and other vegetable substances that are used in dyeing, by means of different articles to precipitate and change the colours produced from them. I have no doubt but that, from the hints here given, the subject will be pursued, and improved till it becomes perfect; and

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that no bankers cheques, bills of exchange, promissory notes, receipts, or other securities for money will be executed except they are written on paper covered with a small pattern, printed with a pale and delicately coloured Ink that on the application of an acid, for the purpose of obliterating the writing, will immediately change colour and expose the fraudulent attempt; and if, by making the process more easy through the medium of this publication, I should be the means of preventing the commission of crime, it would be to me the highest gratification I could feel in this world.

If we take a retrospective view of what has been laid before the public upon this subject, which forms a part of the most important invention that ever was discovered for the moral and intellectual edification of mankind, — it seems incredible that from the year 1677 to the present time no improvement whatever has been promulgated on the subject of preparing Printing Ink, with two exceptions, neither of which were applicable to general purposes; namely, that published in the Encyclopædia Britannica, which could not be used for any but the commonest work, and that which I published in Practical Hints on Decorative

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Printing, which was only suitable for the finest work; thus the great mass of printing, consisting of book work generally, and all jobs above the scale of ballad printing, were left for their means of execution to the imperfect knowledge and skill of the very few ink makers by profession; for I believe there are not three printers in the United Kingdom who could form a good Ink for general purposes *de novo;* a state in which perhaps no other trade is situated:—it stands thus:—

Moxon published the Dutch method of preparing Printing Ink in 1677; but from the scarcity of his work, and the obscurity of the title as connected with printing, it is little known among printers.

Fertel, a French printer at Saint Omers, published a practical work on printing in 1723, in which he gave a method of preparing Printing Ink,—which is evidently derived from the same source as Moxon's, with the manner of making smoke black. This is also a book very little known.

Breton, printer to the King of France, supplied the article on printing to the Encyclopédie, in 1751, in which the method of making Printing Ink and smoke black is similar to that in Fertel's book. The Encylopédie, being a

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voluminous and expensive work, in the French language, is not a book of general reference.

Dr. Lewis published, in 1763, his Philosophical Commerce of Arts, in which he details the results of some experiments in boiling different sorts of oils, to ascertain their relative qualities for making varnish; and for the process of making Printing Ink he quotes Breton as his authority. He does not give any new fact in making the article. It is evident that Lewis had not seen Moxon's work; for in speaking of turpentine, according to Breton's method of preparing it, he suggested whether rosin might not answer the same purpose; whereas Moxon does not mention turpentine, but expressly directs the use of rosin.

Papillon, a celebrated French engraver on wood, published a Treatise on Engraving on Wood in 1766, in which he gives the method of making Printing Ink, and refers to Breton's article in the Encyclopédie; but his process does not differ from those of Fertel and Breton. His work is scarce.

Baskerville's method, published by Mr. T. C. Hansard, in 1824, is short, general, and unsatisfactory, does not elicit any new fact, nor could an Ink made from it be used in the general routine of business.

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The receipt given in the Encyclopædia Britannica is the first original article on the subject, to meet the present expeditious mode of working; but the editor candidly acknowledges "that Ink made in this manner is inferior in point of colour, and is likewise more apt to daub the types and make an indistinct impression, than such as is prepared by some of those who make the manufacture of this commodity their employment." Although an approximation to a better article, it still is so deficient as not to produce any beneficial results.

Nicholson, in his Dictionary of Chemistry, published in 1795, gives a vague article on this subject, taken from Lewis, whose authority was Breton; of course this article gives us no new information.

The Messrs. Aikin, in their Dictionary of Chemistry, avowedly take this subject from Lewis, who copied Breton; neither does this give us any additional facts.

The article on this subject in Rees's Cyclopædia is quoted from Lewis. It of course does not advance our knowledge.

The Manual of Printing, a French work, published in 1817, on this subject, is nearly a copy of Breton's article, and gives nothing new.

What I published in 1822, was for a fine

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and expensive Ink, which was too dear for general purposes.

It thus appears that all the French writers to the present day are little more than copies of Moxon's Dutch method, without once mentioning him, and not one of them has been previously translated; and all the English writers, subsequent to Moxon, have quoted Dr. Lewis, who avowedly took Breton for his authority—with the exception, as I have before observed, of the Encyclopædia Britannica and the receipt I published—a lamentable state of knowledge, in these enlightened times. It shows in the strongest manner a great want of information on the subject.

I now come to a conclusion; having treated of the causes that have hitherto prevented us from having Printing Ink of a superior quality as an article of commerce;—of the fallacious directions given by preceding writers, with their receipts, and the plagiarism of many of them;—of the different articles necessary to form black Printing Ink of different qualities, with observations on their respective properties;—of the implements necessary for the process;—of preparing the varnish, and the proportions of the different articles;—of coloured Inks, their properties, application, and

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best contrasts to produce effect;—and of Inks for bankers cheques, &c., to prevent fraud. As a first essay on this subject, it cannot be expected that the work is perfect, for I am the only person who has attempted to lay before the Public a detailed and unreserved account of the process, and perhaps there is no other individual who could have given so much information. I do not mention this as a boast, but as a fact, for there are few printers who have had so long and so varied a practice as I have had, combined with a persevering resolution to overcome the difficulties attendant on this pursuit; and in printing in colours, I believe I have had more experience than any other person.

I can truly assert, that every statement I have made is the result of my own practice; and that there is not a direction in the book for preparing an Ink but what I have prepared and used myself to a great extent, and found them answer in the most satisfactory manner; they have also been used by some of the best practical men in the metropolis, who have awarded to them the highest meed of praise.

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Note.—This volume is not printed with ink made from any receipt of the Author, but with the ink of commerce.

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